HAMILTON TRADE CENTRE AND ARENA

HAMILTON, ONTARIO

16 DECEMBER 1982

FINAL DESIGN REPORT

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

Parkin Partnership

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PROJECT NO. 8207

TABLE OF CONTENTS

	PAGE
ARCHITECTURAL DESIGN	01
STATISTICAL SUMMARY	07
ARCHITECTURAL DRAWINGS	10
STRUCTURAL ENGINEERING SYSTEMS	17
STRUCTURAL DRAWINGS	19
MECHANICAL ENGINEERING SYSTEMS	26
MECHANICAL DRAWINGS	39
ELECTRICAL ENGINEERING SYSTEMS	44
ELECTRICAL DRAWINGS	50

ARCHITECTURAL DESIGN

General

This report describes the design of the building based on the following drawings dated 15 December, 1982.

Drawing	Title
DE-D101A	Rink/Exhibition Hall Level Plan
DE-D101B	Rink/Exhibition Hall Level Plan (Ice Hockey Surface Layout)
DE-D101C	Rink/Exhibition Hall Level Plan (Single Performer Stage/Seating Layout)
DE-D102	Street/Mall Level Plan
DE-D103	Concourse/Plaza Level Plan
DE-D104	Mezzanine Level Plan
DE-D105	Sections
DE-D106	North and West Elevations
DE-D107	South and East Elevations

Introduction

The program for the Hamilton Trade Centre and Arena calls for a multi-use building containing a 60,000 sq. ft. exhibition hall and an ice hockey rink with seating for 18,000 spectators. Together with an appropriate range of support spaces, these are the major requirements to be met in the design of the facility.

Concept

The concept developed for the building proposes an oval structure with uniform rows of seats around the ice surface. The lower sections of seating, or half of the arena, are on telescopic platforms, and these can be removed to provide an exhibition hall extending under the seats and across the ice surface as well, if this is needed.

The Site

The site is an area 480 ft. x 350 ft. more or less, bounded on the north and west sides by York Boulevard and Bay Street respectively. On the south and east it is contiguous with the shopping mall of Lloyd D. Jackson Square, to which there are two main entrances, and from which there are a number of fire exits that have to be provided for within the layout of the plan.

Also to be accommodated on the Trade Centre/Arena site are truck access ramps to the loading dock of the Standard Life Building and from the delivery area of the Farmers' Market.

General Arrangement

The elevation of the truck ramps below the street is at a level convenient for the ice surface of the Arena. There is a 4 ft. difference between the loading dock for the Standard Life Building and the ramp from the Farmers' Market. Advantage was taken of this when planning the layout of the Arena. The loading bay on the south side allows trucks to off-load directly onto the Exhibtion Hall floor, while the ramp at the east end allows vehicles to drive straight onto it. Having both of these kinds of connections on the same floor is a major advantage in operating a building of this type.

Concourse

The Arena contains two main tiers, one above the other, forming a single, open bowl of seating. At an intermediate level, and under the upper tier, there is a main Concourse that runs right around the building. A major circulation space for spectators, the Concourse provides access to the aisles serving the seating. Around its perimeter are contained concession stands, washrooms and the entrance and exit doors to and from the building. It might be noted in passing that for the convenience of patrons the number of washrooms being planned for the building is approximately twice that required by the Code. They are located around the perimeter of the Concourse in a way that provides easy access to all.

Two small rooms are provided off the Concourse for first aid and building security. A Club Room for the use of season ticket holders has been planned for the area over the exit stairs on the north side of the building. The VIP room mentioned in the Program can either be incorporated in this space, or separated off from it if need be.

The entrances to the building lead directly to the Concourse, and from there to the seats, so that the layout of the building from the spectator's point of view is relatively simple and straightforward. It should present no problem to anyone trying to find their way - something which will be of great advantage as the building is used.

Concourse (Continued)

The Concourse is one level above the street, at the elevation of the plaza over Lloyd D. Jackson Square. This facilitates access into the building by patrons coming from the south east corner of the Square, and as well has important ramifications in terms of the fire exiting requirements from the Arena. The open Plaza above the shopping mall has elsewhere been accepted as "grade level" in terms of the Building Code, and certain concessions are available for exits to it that are much more efficient than the exits that go down the stairs to the street.

Seating

Aisles lead from the Concourse down to the main tier of seating, or up by means of short stairs to the mezzanine. Provision is being made for the later construction of private boxes around the perimeter of the main tier at the Concourse level. The boxes, which are expected to be finished by their occupants, will have plumbing and wiring roughed in. Windows at the front can be slid down out of sight to allow the occupants full participation in the excitement of events in the Arena.

Camera locations, TV lighting and follow spot platforms are all identified and provided for in the plans. Also proposed is a "gondola" style Press Box, accessible at catwalk level. Discussions with representatives of the local press corps, have indicated that this is the desired location for their facility. A passenger elevator, used also by the handicapped, allows members of the press to get from the gondola catwalk level to the players' dressing rooms without having to pass through the crowds in the general spectator areas.

Retail Space

An intermediate floor at street level between the rink and the Concourse, acts as extension of the retail shopping mall in Lloyd D. Jackson Square. A relatively narrow space under the seats, it nevertheless provides room for an extension of the shopping mall out to York Boulevard in one direction and Bay Street in the other. It contains as well areas suitable for Building Administration, the Concessionaire's offices, and the Home Team offices; all readily accessible from the street.

Restaurant

On the north side of the retail level, adjacent to the main routes to York Boulevard, a location has been suggested for a Restaurant. Although the Restaurant is a requirement of the Program, further consideration may wish to be given to the feasibility of this item based on the experience of other food service operations in the Square. Suffice it to say that the location indicated seems the most suitable one for such a function within the overall planning of the building. It allows the possibility of allocating additional space (to the west) with a separate entrance for a bar, and could also provide kitchen service to the Club Room above. It may be possible to find an operator for the Restaurant who is also interested in handling the Concessionaire's franchise, thus providing a more flexible overall food service operation in the building than if these two activities were handled independently.

Main Entrance

A building of this sort needs an identifiable "Main Entrance", where tickets can be purchased and where people can enter for all events. Such an entrance is provided on Bay Street. Wide doors, with a brightly lit marquee, lead to a lobby where tickets are taken, and from which stairs and escalators lead to the Concourse. Ticket windows nearby can be reached either through the entrance itself or from the shopping mall on the south side.

In the case of a Trade Show or when there is seating at rink level, patrons can proceed down other escalators to the lower level. Nearby, an elevator provides access for the handicapped. (As mentioned above, it doubles as a means of travel getting from the Press Box to the Team Dressing Rooms without having to go through the general spectator areas.)

Other entrances are provided at the east end of the building. The one for the Arena seating off the Concourse is at the level of the Plaza above Lloyd Jackson Square. This can also be reached by means of stairs and escalators up from the mall at street level. Nearby on the mall, a separate entrance gives access to the exhibition hall and rink level seating. This additional entrance has been introduced specifically to facilitate access to trade shows by people in the mall and those who will be staying in the hotel planned for the site just east of the Standard Life Building.

Rink Level

Other details of the layout, specifically at Rink Level, may be of interest. Following a recent meeting of the Sub-Committee, this entire floor has been re-planned. It has been found that by relocating the players' dressing rooms and associated areas, formerly located to the north-east and north-west of the rink, to a location on the south side of the ice surface, that a large open space can be provided across the north half of the floor, some 61,000 square feet in extent. In effect this assembles in one area all the space previously provided at separate locations for storage and staging, as well as the exhibition hall. Together with the area made available when the movable platforms are removed, and the area occupied by the ice surface, this makes a space of some 87,000 square feet in extent: sufficient for all but the largest trade shows and exhibitions available in North America.

Having such a large flexible space on this level provides other advantages as well. At 61,000 square feet, it is large enough to provide space for exhibitions even when the ice surface is in use. On the other hand, since the so-called "staging area" is not differentiated from the rest of the floor, staging space can extend into the open floor as far as necessary, to allow major ice shows and circuses to be assembled. Some space will have to be assigned for storage, but this can be kept to the perimeter and will take the minimum amount of space required, rather than a pre-determined allowance assumed early in the planning.

Movable Platforms

The movable platforms used for the front rows of seating can be pushed back out of the way when not needed for spectators in the Arena. Consideration is being given to re-using the seating now owned by the City at the Convention Centre, and revising the platforms to fit the row to row height of the Arena. It is hoped that they can be fitted with closed backs and sides to provide a finished appearance in the exhibition hall when the two spaces are used simultaneously.

Ice Surface

The ice surface itself is designed for regulation NHL and International size rinks. Sockets for dasher boards will be provided at both locations. In this regard it should be noted that the sight-lines are based on an NHL rink, and may not be ideal when the surface is enlarged for international events.

The ice can be left in and covered, or removed completely for trade shows, as the sponsors decide. Some arenas report that the ice is left in unless comfort of users is a factor, or the loads to be carried over the ice are such that they will damage the protective sheets that cover it. An additional premium can be charged to pay for the costs of taking out the ice.

Dressing Rooms

Dressing rooms for players are all at rink level. Separate areas are designated for opposing teams with their own entrance onto the ice, and officals can use yet another entrance. A range of sizes for the dressing rooms, as designated in the program, provide maximum flexibility in use. Some of the dressing rooms are at the end of the ice with the "Staging Area" - open space for the set-up of ice shows, etc. These dressing rooms can double for performers and stars for theatrical events.

Service Areas

At the other end, near the Home Team Dressing Rooms, are facilities for TV and the Press, as well as maintenance rooms, lockers, etc., and storage and other facilities for the Concessionaire. Concessionaire's and Maintenance spaces, and the Staging Area are all served from the loading area, but the routes to them are in opposite directions and do not conflict. A major service elevator connects this floor with the street level and with the Concourse. There is a separate entrance for people who work in the building, via a security office.

The drawings indicate four sets of exits from the rink level to the street, and locations for concession stands and washrooms around the perimeter of the Exhibition Hall. Additional concession stands can be set up on a temporary basis when required.

Exterior Treatment

The exterior treatment of the building reflects the interior layout. The seating is identified in a wide band around the top of the building, with the stepping of the floor showing below. Another band encloses the Concourse and the spaces at mid-level. At street level, shop front glazing gives a view into the retail area of the building.

Except for the entrances, there is a minimum of glass to the Arena property. This reflects the need to allow black-outs for ice shows and other theatrical events when required.

Pre-finished steel cladding is proposed for the exterior. Generally light in colour, certain areas such as the underside of the seats and the entrances, will be picked out with a bright accent. Flags and signage will be used to add a festive air to the surroundings. Exterior lighting is being given special attention to provide a dramatic display for night-time events.

STATISTICAL SUMMARY

Rink/Exhibition Hall Level	Exhibition Hall, including Storage and Staging Areas.	61,026 sq. ft.
	Exhibition Hall including ice surface and space vacated by movable platforms.	87,060 sq. ft.
	Loading Area	4,835 sq. ft.
	Trash Room	1,145 sq. ft.
	Home Team Dressing Rooms	4,010 sq. ft.
	Lockers (West End)	2,025 sq. ft.
	Visitors' Change Room	1,320 sq. ft.
	Lockers (East End)	1,165 sq. ft.
	Officials	570 sq. ft.
	First Aid	105 sq. ft.
	Press	2,060 sq. ft.
	Vendors' Storage	1,705 sq. ft.
	Vendors' Lockers	409 sq. ft.
	Ushers' Lockers	580 sq. ft.
	Laundry	625 sq. ft.
	Zamboni	450 sq. ft.
	Elec./Pump Room/Tel.	4,490 sq. ft.
	Maintenance	590 sq. ft.
	Mechanical (Ice Making)	2,110 sq. ft.
	Washrooms (Exhibition Hall)	320 sq. ft.
	Washrooms (Exhibition Hall)	330 sq. ft.
	Concession Stands	
	North East	50 lin. ft.
	North West	26 lin. ft.
	South West	20 lin. ft.

Street/Mall Level		
	Retail Areas (total)	32,965 sq. ft.
	Retail Corridors	16,370 sq. ft.
	Restaurant	9,965 sq. ft.
	Home Team Offices	2,065 sq. ft.
	Conessionaire's Offices	1,200 sq. ft.
	Building Administration	1,620 sq. ft.
	Ticket Sales and Office	1,855 sq. ft.
Concourse/Plaza Level		
	Concessions - 15 locations	
	Total Counter Length	390 lin. ft.
	Washrooms	
	Men (4)	185 Urinals
		33 WC
	Women (4)	139 WC
	Club/Lounge	4,840 sq. ft.
	Vendors Stations	
	North East	1,120 sq. ft.
	South East	360 sq. ft.
	South West	360 sq. ft.
	Lost and Found	350 sq. ft.
	Security/Holding Area	690 sq. ft.

Seating

Rink Level	(2,020)	seats
Removable Platforms	2,546	seats
Main Tier	7,215	seats
Mezzanine	8,282	seats
	18,043	seats

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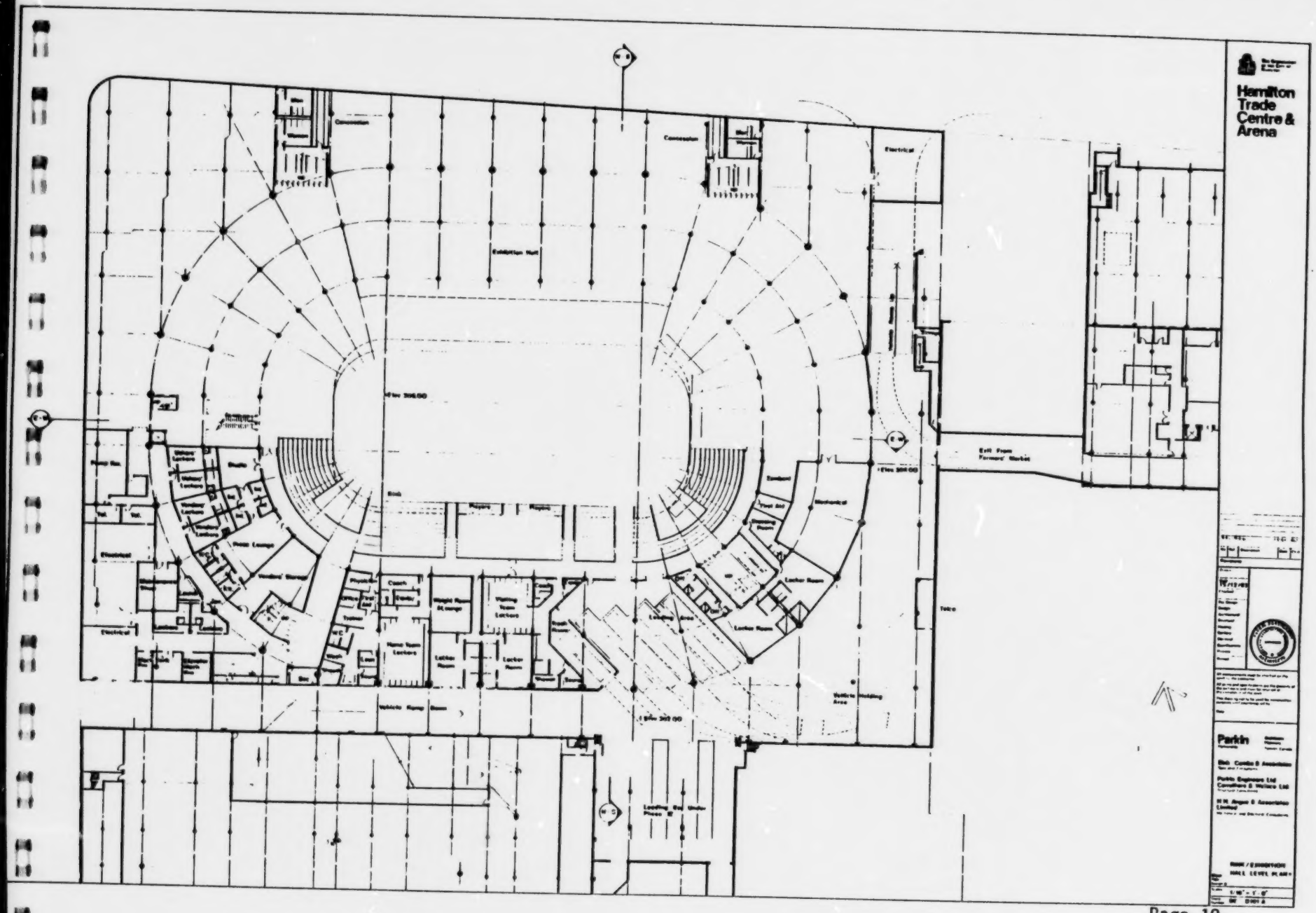
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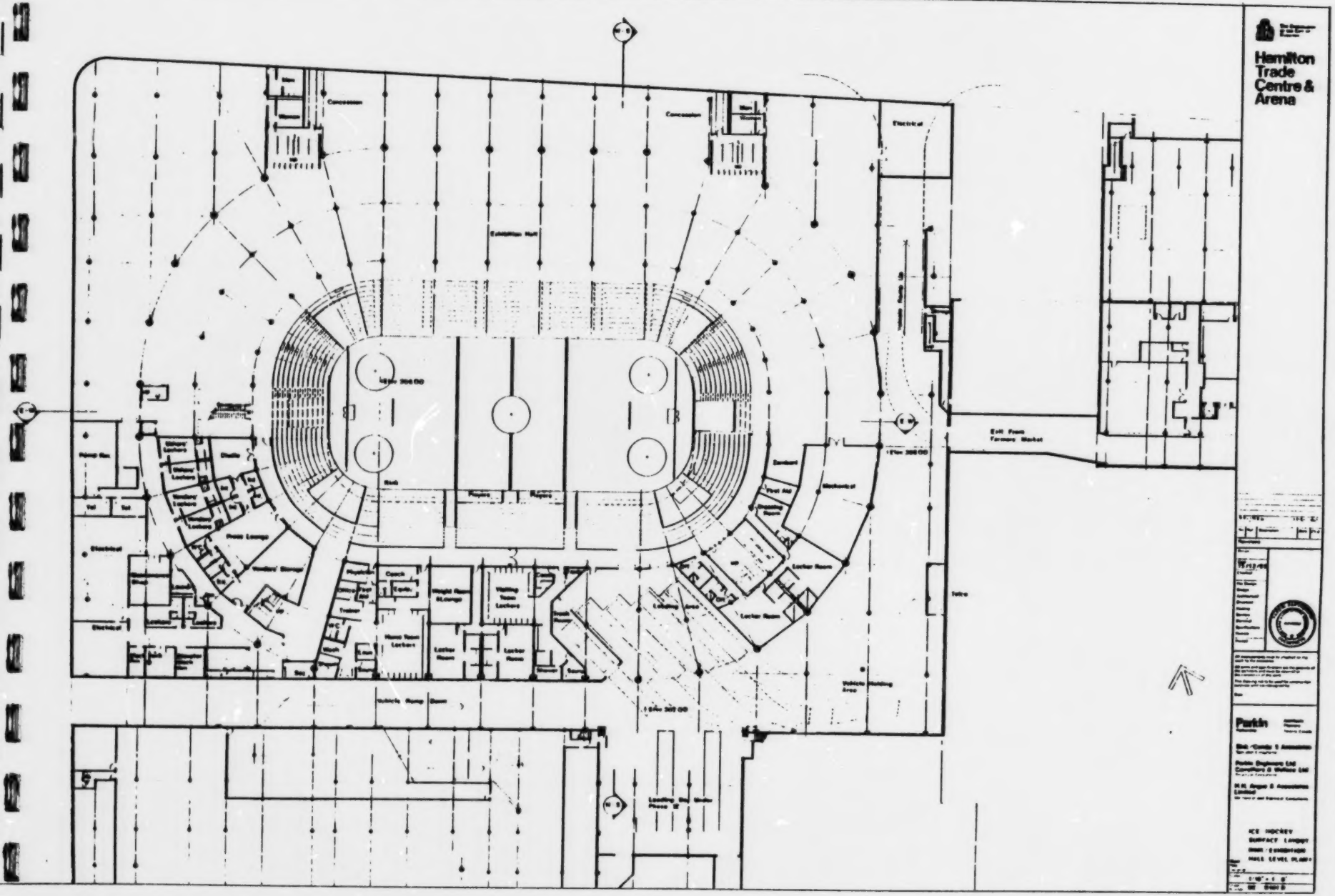
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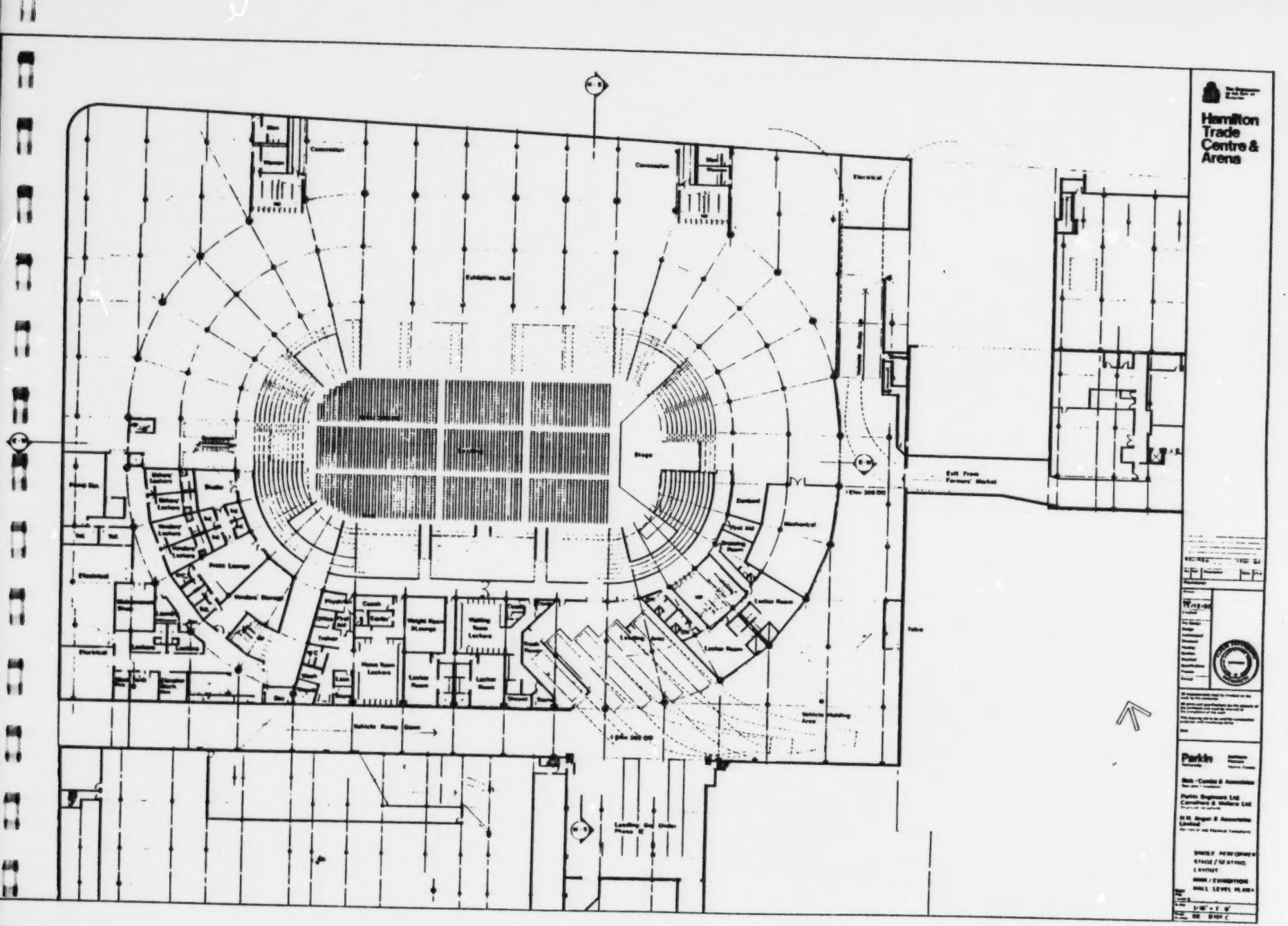
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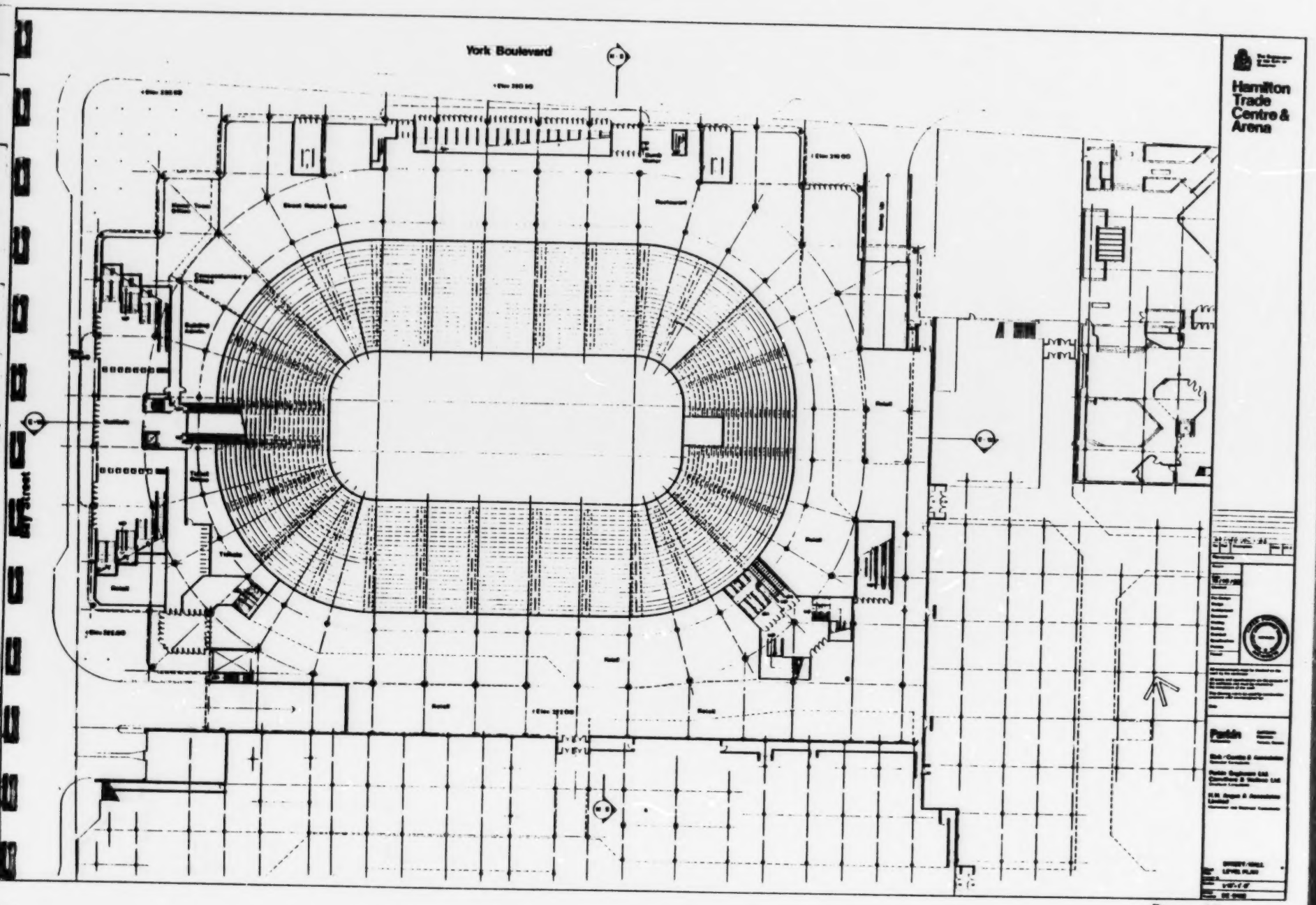
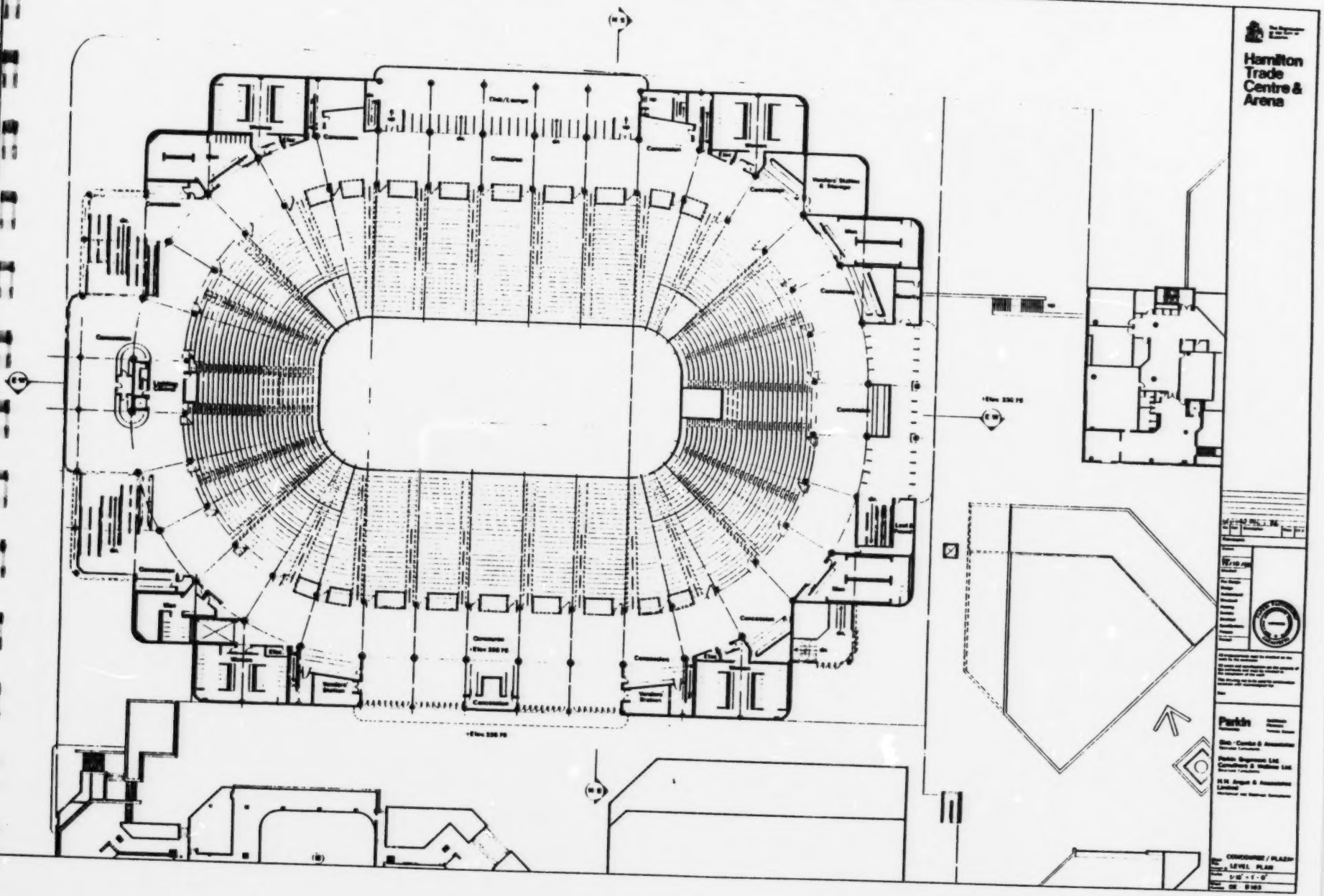

York Boulevard
Hamilton Trade Centre & Arena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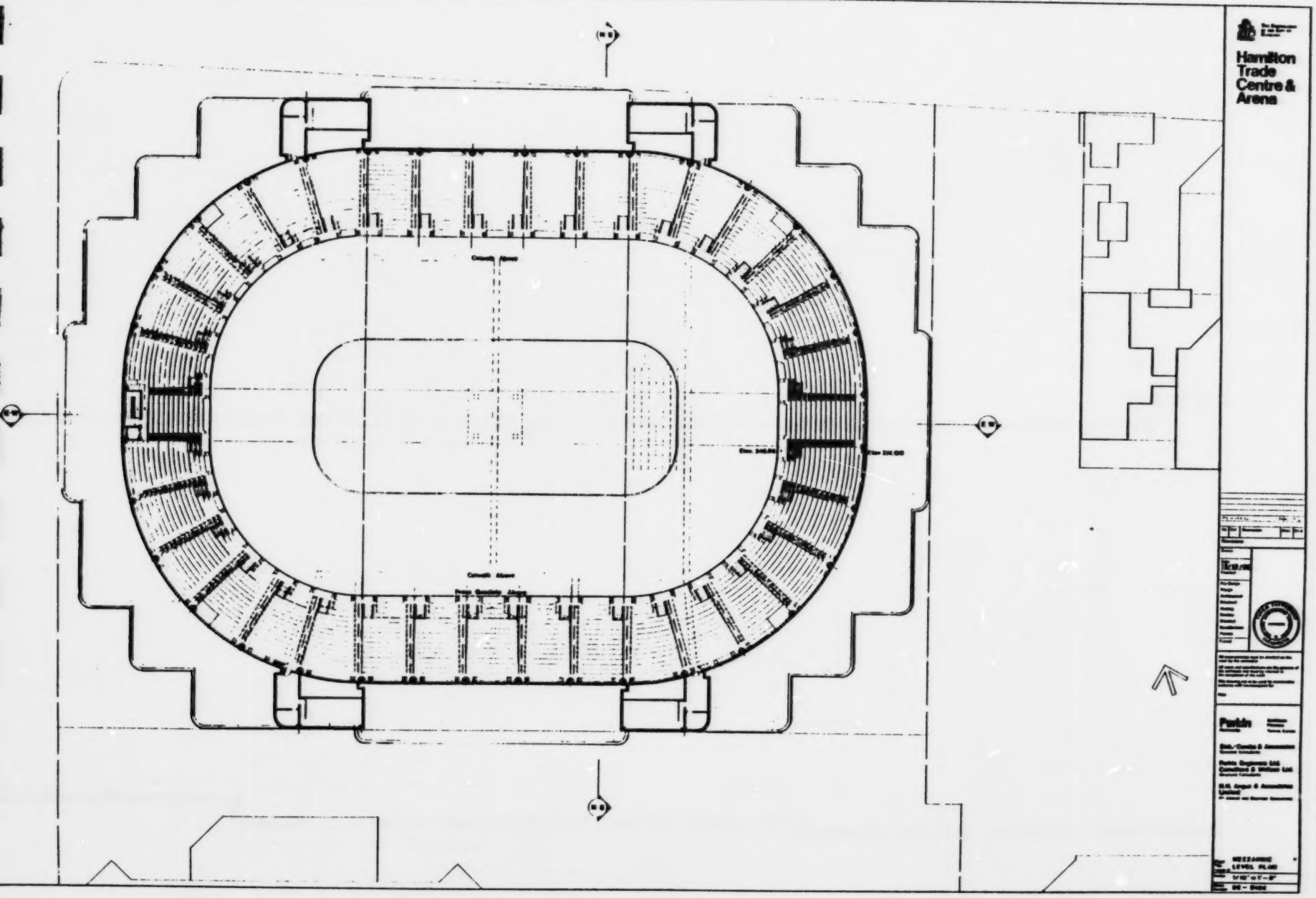
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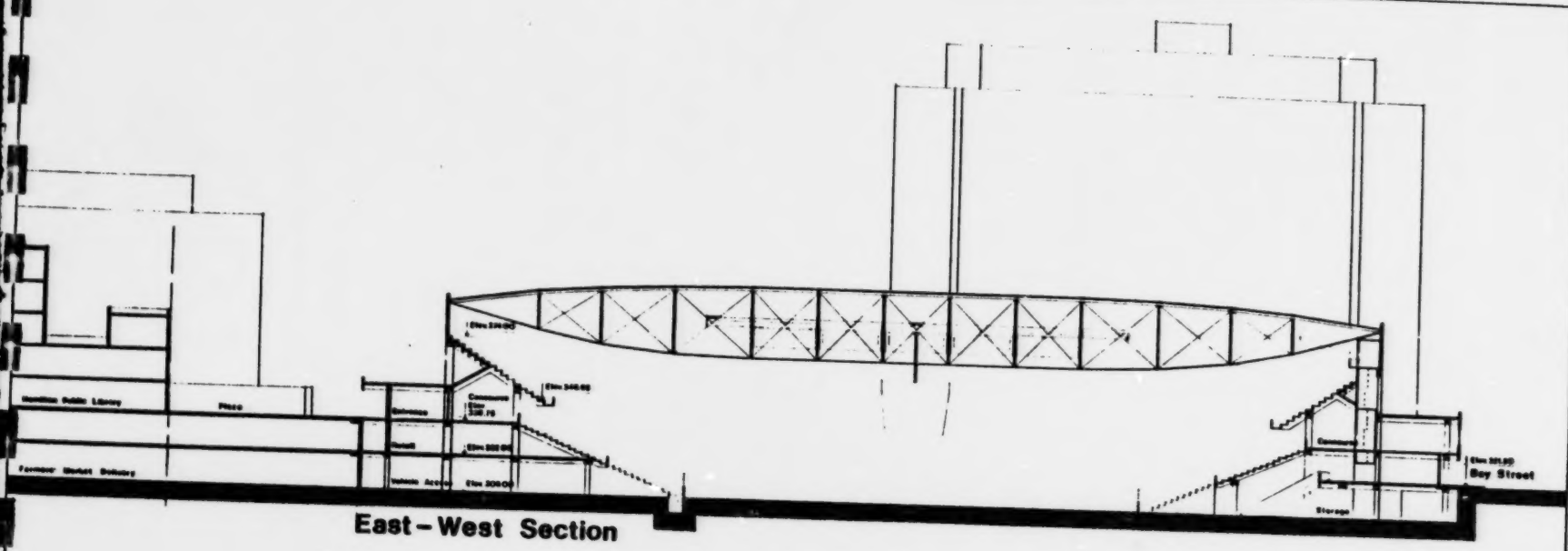
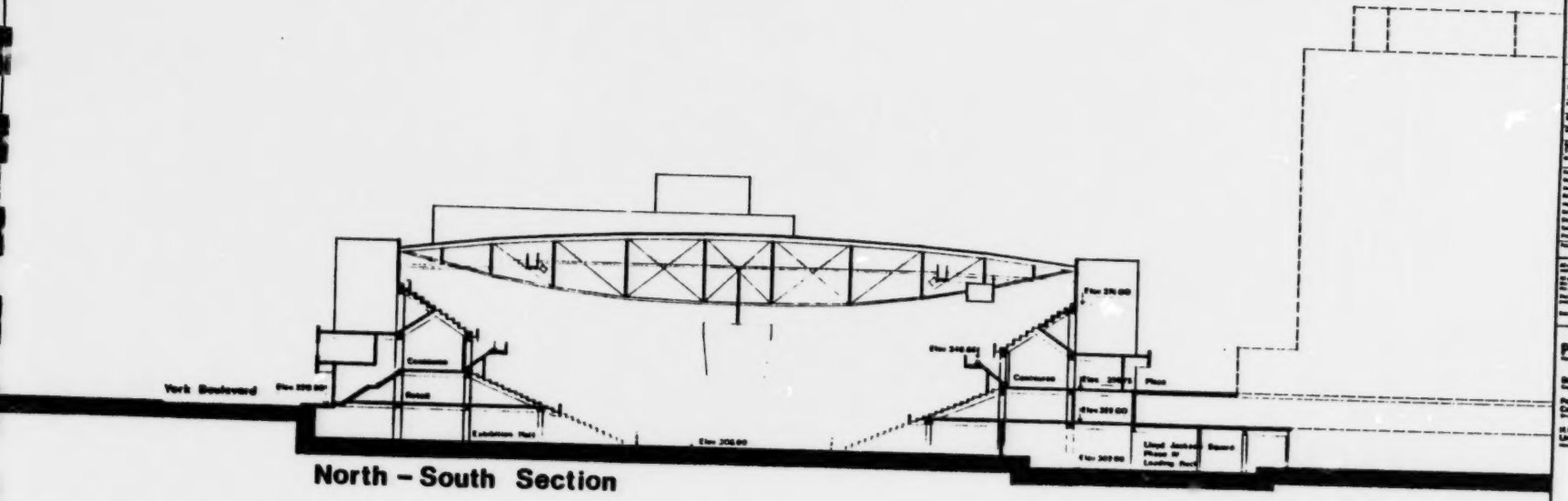


East – West Section



North – South Section

Hamilton Trade Centre & Arena

STRUCTURAL ENGINEERING SYSTEMS

General

The structural systems chosen for the Arena/Trade Centre complex have resulted from consideration of the functional aesthetic and economic requirements and have been adopted after investigation of many alternative solutions.

Fire Resistance

The fire rating requirements of the structure have had a considerable influence on the choice of structural systems, particularly because of the introduction of retail-commercial space in the street level area. This space requires a three hour fire separation of floor and ceiling from the adjacent Arena/Trade Centre areas.

The functional requirements of durability, resistance to lateral and seismic forces, as well as control of vibration, have influenced the choice of systems to be utilized on construction.

The final choice in each instance has resulted from considerations of the functional, aesthetic and economic performance of the alternative systems available.

Foundation

A soils investigation has been carried out at the site and has shown that a number of foundation systems are economically viable. The presence of a hydraulic head at the interface between the underlying till and bed rock would seem to rule out the use of a belled caisson solution. A straight shaft caisson to bed rock, strip footings on sand and isolated spread footings on sand are still under consideration.

Street and Concourse Levels

Due to the presence of the retail/commercial area at street level, the structural systems for the street level and the concourse level require a three hour fire resistance rating. This requirement dictates a minimum concrete slab thickness of 6 inches and a concrete cover of 1-1/4 inches to the reinforcing steel in the slabs.

Street and Concourse Levels (continued)

The requirement for resistance of seismic forces in any direction dictates the presence of moment resisting frames in each direction within the structure.

We have investigated the use of flat slab construction, concrete joists on one way beams, waffle slabs on two-way beams and two-way slabs on wide flat beams. Our evaluation of the economics and performance of the systems has lead us to recommend the use of the two-way slab on wide flat beam solution.

Stepped Seating

The stepped seating areas have two different fire resistance requirements. The seating below the concourse level serves as the enclosure of the street level mall and therefore requires a three hour fire rating. The mezzanine seating requires only a one hour rating.

We have investigated the options of poured in place slabs on poured in place beams, poured in place slabs on steel beams, precast concrete slabs with and without a poured topping on both poured in place beams and steel beams.

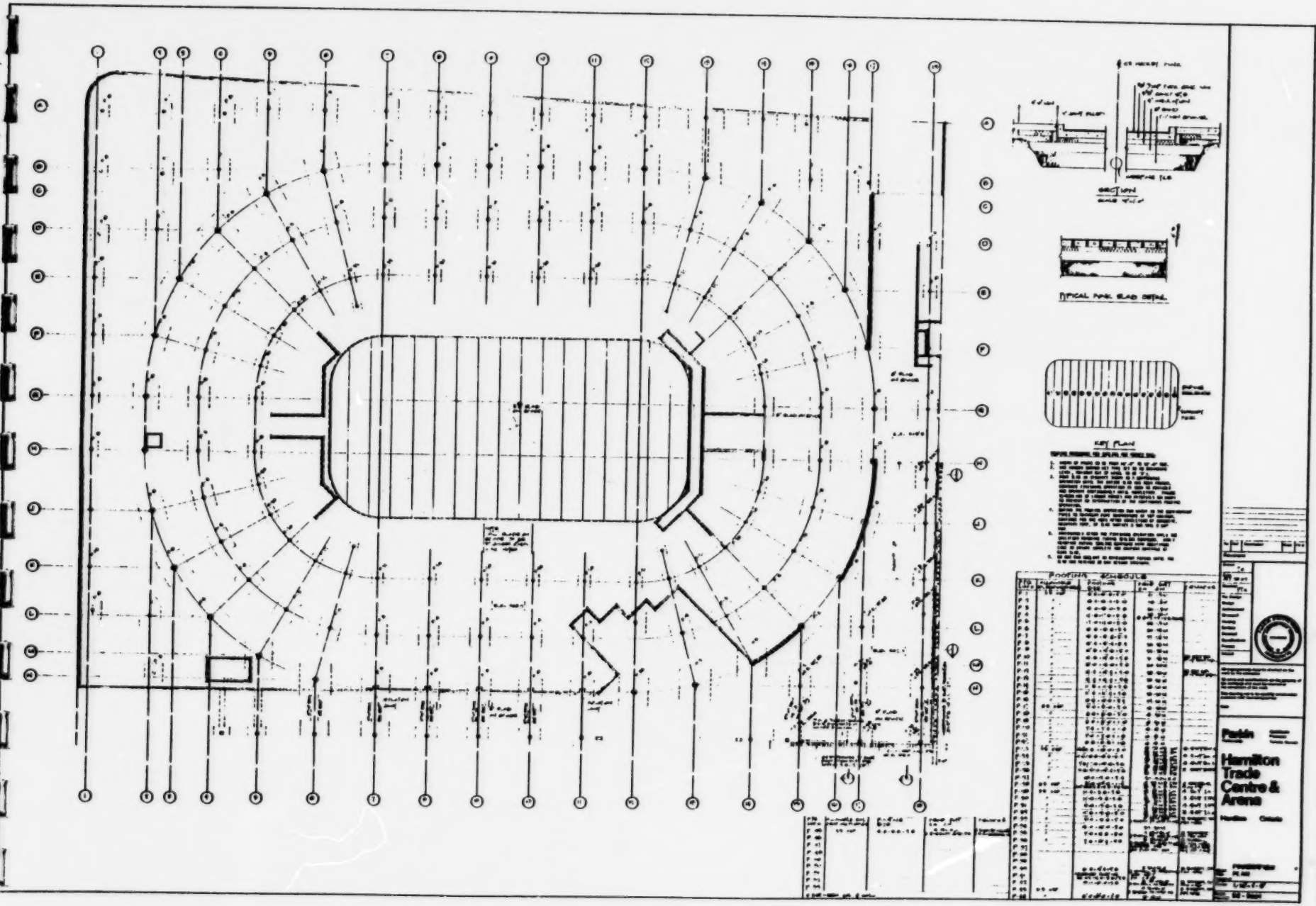
We have concluded that poured in place slabs on poured in place beams best meet the requirements of performance and economy.

Roof

The roof of the Arena/Trade Centre is oval shaped with axis dimensions of 300 and 380 feet. The functional requirements for roof drainage and sight lines allow the use of a lenticular shaped roof form to minimize the height requirements of the structure.

We have investigated the use of one-way steel trusses at 30 foot and 60 foot spacings, one-way steel tied arches, two-way steel tied arches, and an air-inflated double steel membrane.

We have concluded that the use of two-way tied arches in orthagonal directions is the optimum solution from economical and aesthetic considerations.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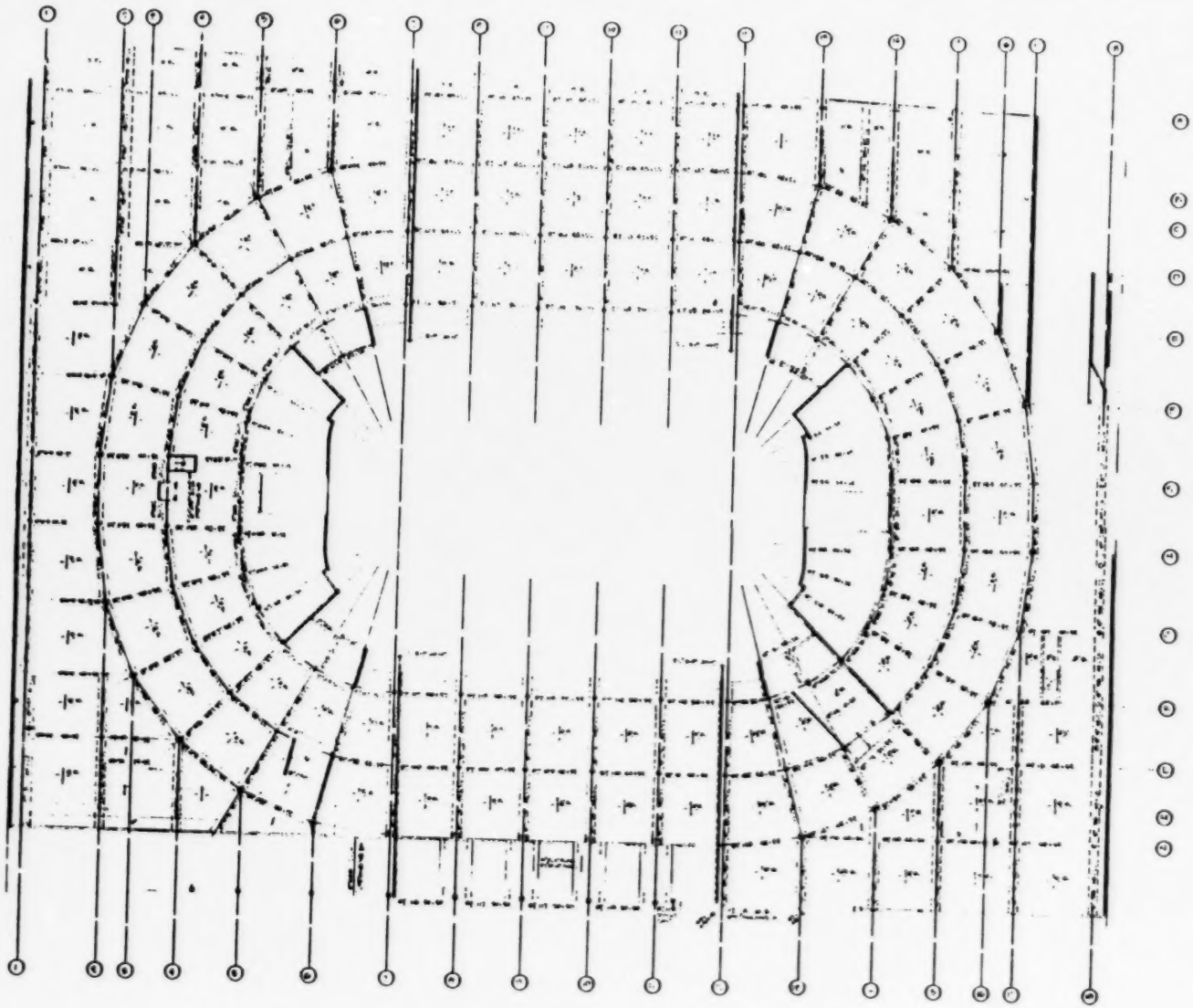

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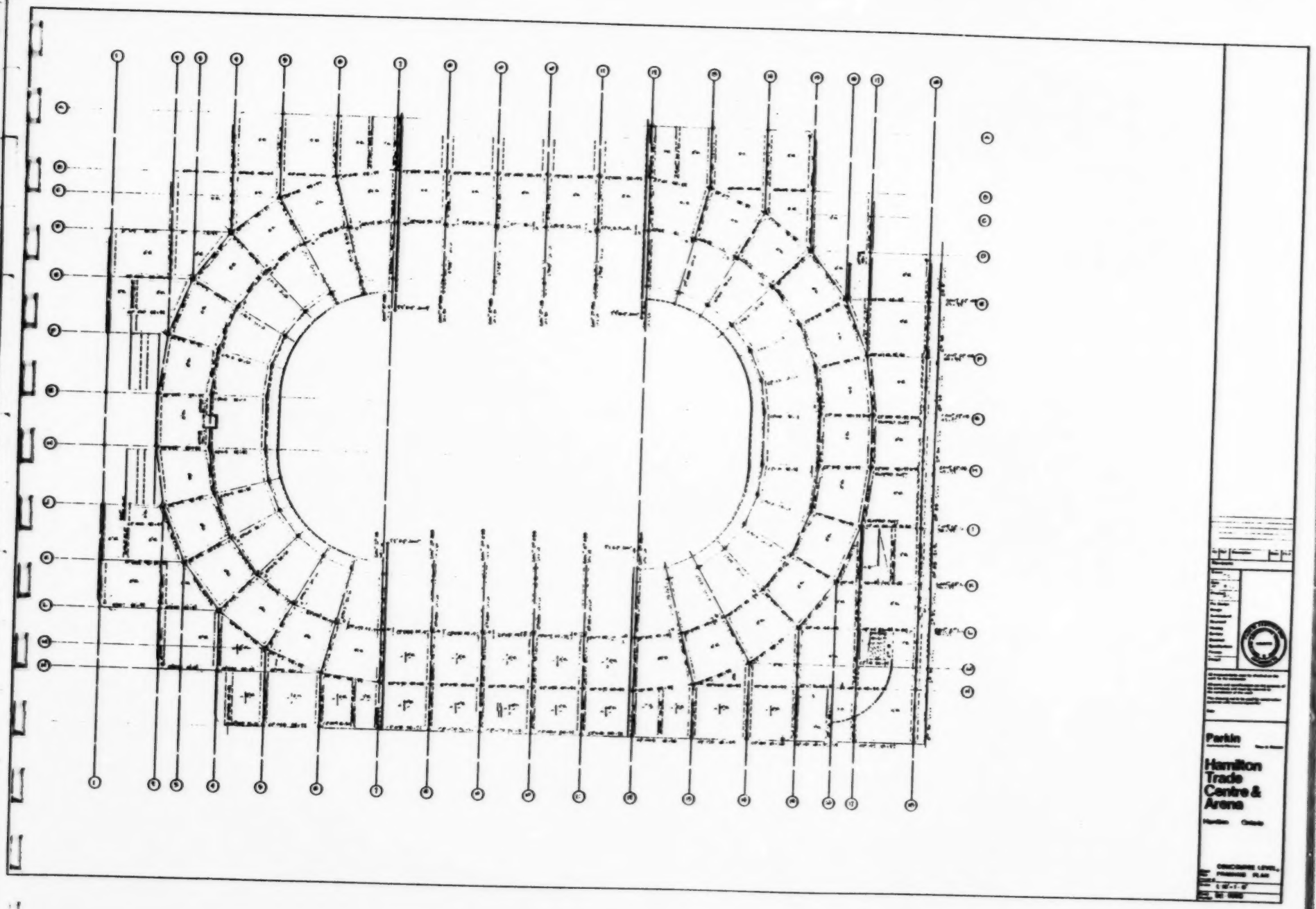
STREET WALL LEVEL FRAMING PLAN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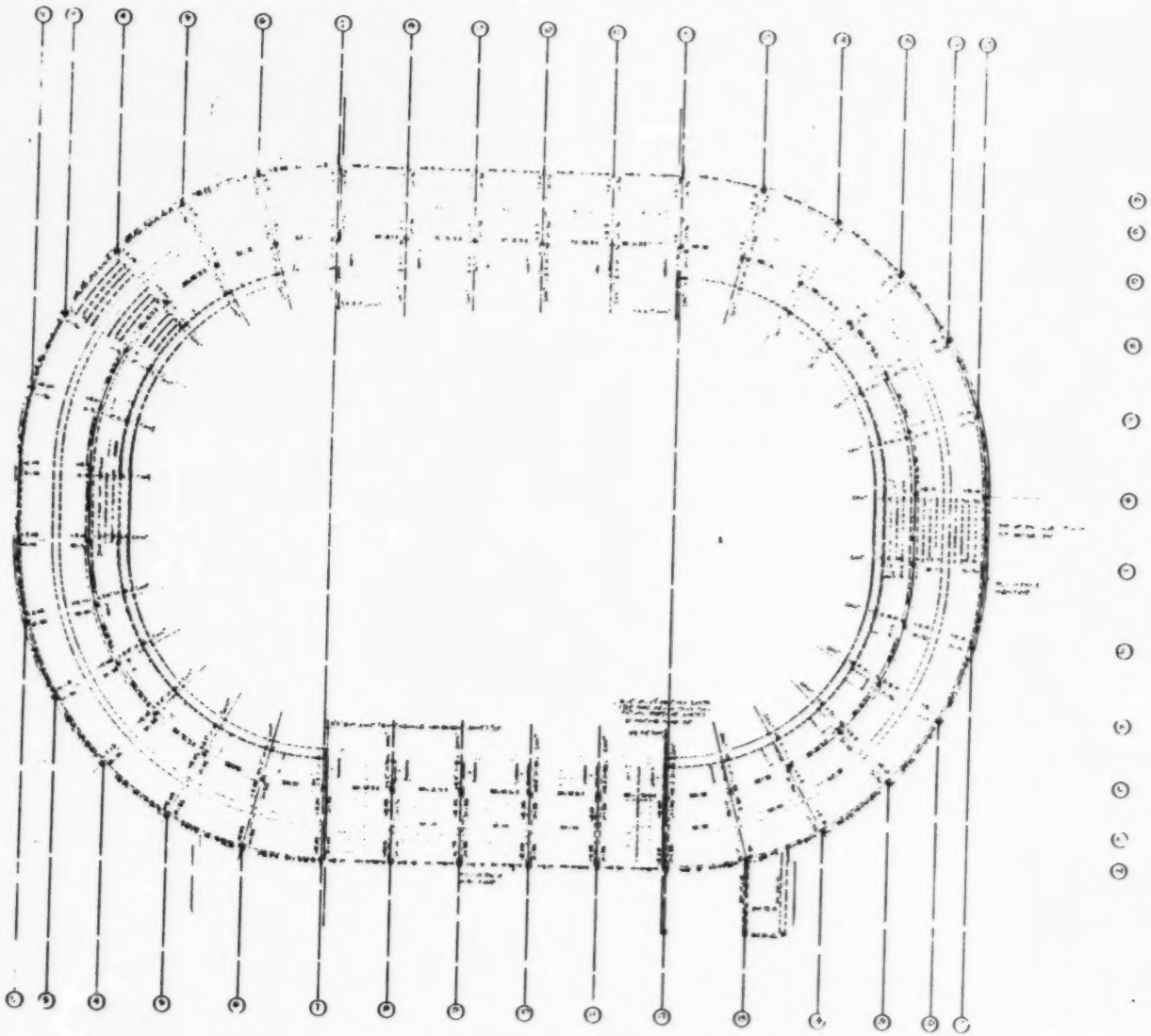

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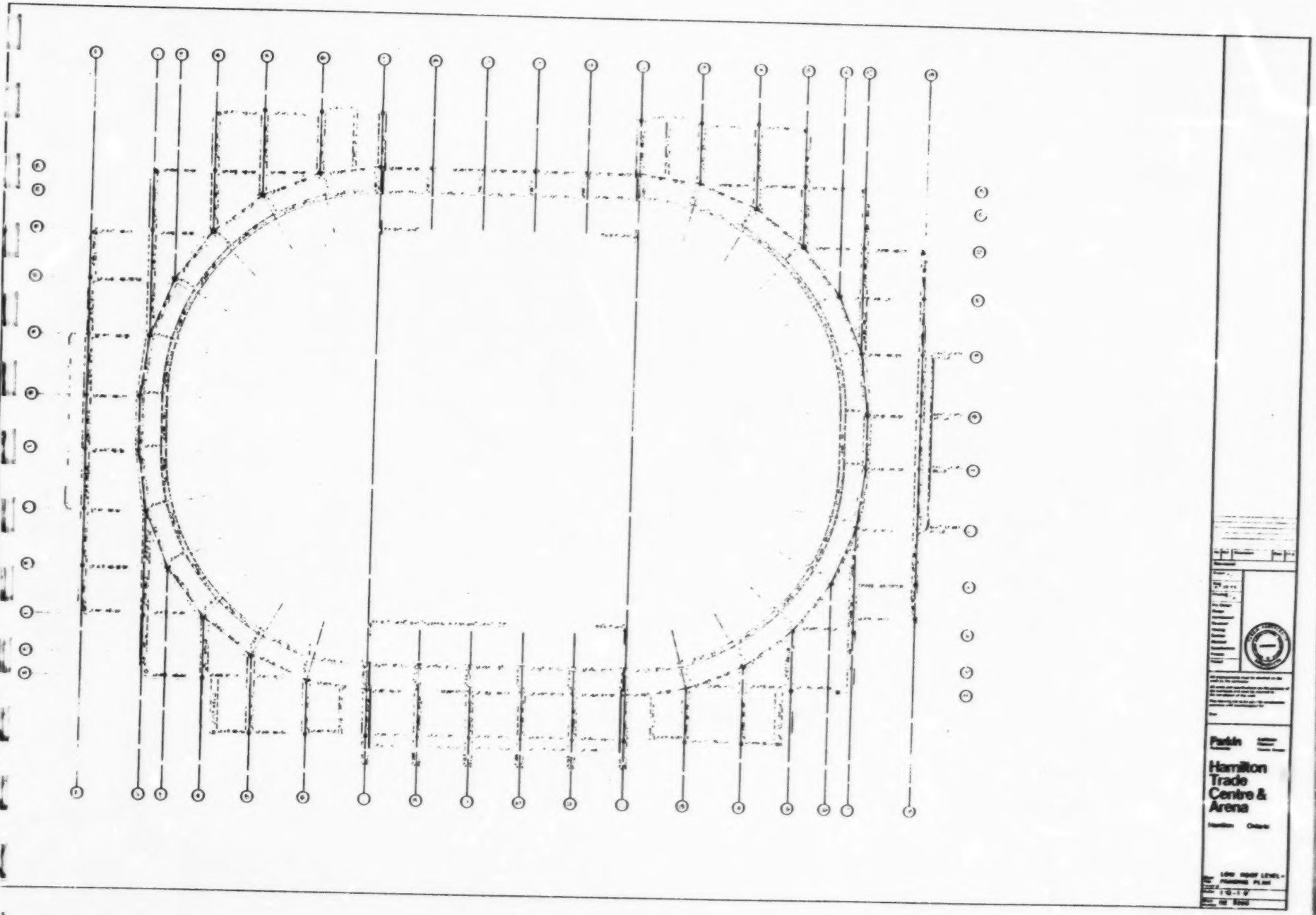
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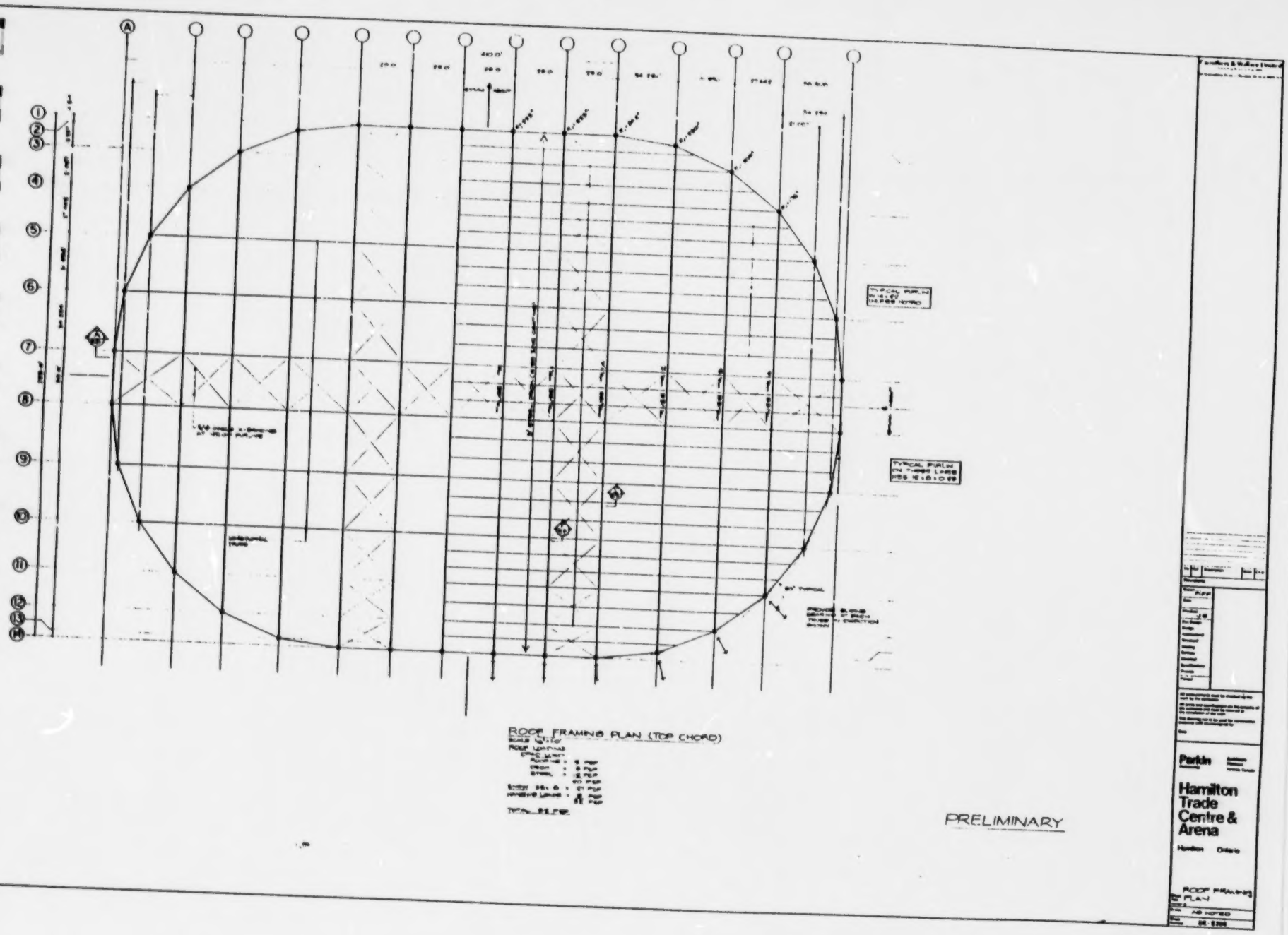

ROOF FRAMING PLAN (TOP CHORD)

PRELIMINARY

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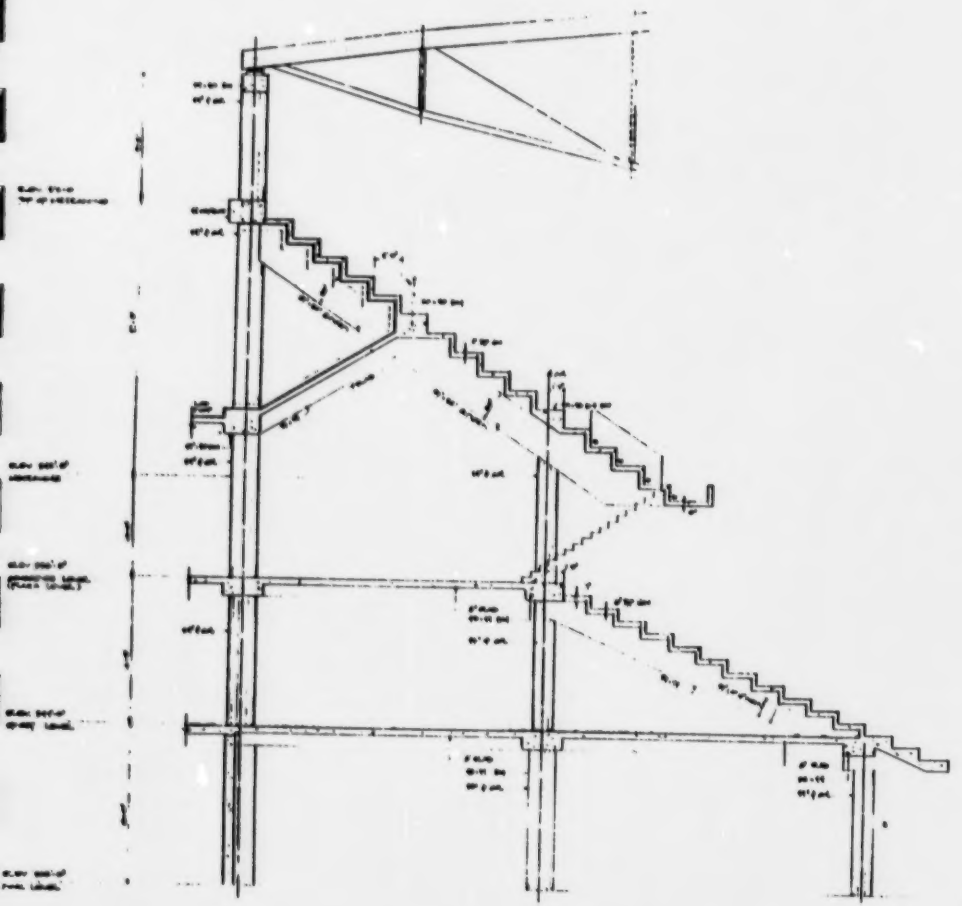
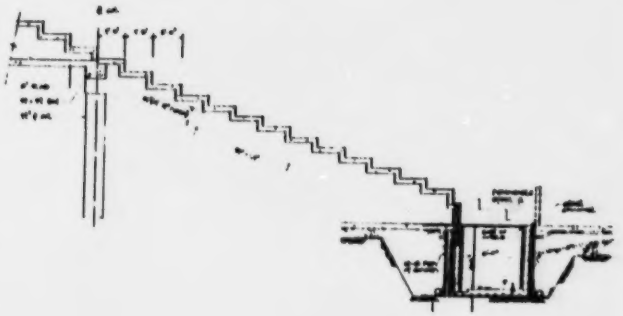
ROOF FRAMING PLAN





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Hamilton Trade Centre & Arena

General

The mechanical design of the building is based on the use of electricity and natural gas as the prime energy source for space heating and air conditioning.

Any excess heat from the air conditioning cycle and the ice making process, will be made available for domestic hot water heating and any other heating needs.

Steam And Hydronic Systems

Four low pressure steam boilers produce steam to meet the various operational requirements:

- Preheating of outside air during cold weather
- Space humidification for special events
- Domestic hot water when condenser water is not available or is unsufficient to meet the demand.

The steam from all of the boilers is distributed through a common pipe loop so that any of the boilers can supply steam to the whole system.

There are two additional completely independent piping loops:

- chilled water piping loop for cooling
- condenser water piping loop for heating

The condensate is piped through a common loop to the condensate receivers and pumped back to the boilers.

Each of the loops has its own pumps, valves, and controls.

Chilled water is produced by four centrifugal refrigeration machines. It is pumped through the "chilled water distribution loop" to the cooling coils located in the central air handling units, fan-coil units and fresh air supply units for the retail area.

In addition, chilled water is supplied to the condensers of the Ice Making Refrigeration Machines to provide the heat rejection cycle of the Ice Making Machines.

The condenser water loop, also called the low temperature heating loop, rejects part of the heat through the domestic water heat exchangers, the reheat coils of the air handling units, or the heating coils of the fan-coil units.

The balance of the surplus heat is rejected through the four forced-flow cooling towers.

The equipment in each of the Mechanical Towers is capable of producing the complete heat rejection requirement of any one of the chillers.

Controls

A computerized central control and monitoring system is used for optimizing the total building operation and may be tied in to Central Utilities Plant at Hamilton Place for after hours monitoring.

Water Treatment

A complete system of water treatment for the chilled water, condenser water and space heating circuits is provided to control corrosion and scale and also inhibit microbiological growth.

The heating and cooling systems employ by-pass feeders across the circulating pumps to add the required chemicals.

In addition, by-pass cartridge filters will remove sedimentation continuously from the closed piping circuits and will ensure that undissolved chemical solids are also removed.

A water softener system will soften the raw water make-up to the system and prevent undesirable scale deposit build-up on the heat exchangers.

Odourless Biocide will be introduced to the cooling tower basins to prevent microbiological growth.

To prevent oil and dirt (inherent to the newly installed systems) from reaching sensitive equipment, all of the systems will be chemically cleaned according to system requirements.

Sound And Vibration Control

The sound and vibration generated in air conditioning and other mechanical systems which can be transmitted into noise sensitive areas will be controlled by the following means:

- Major sound sources, such as fans, will be separated from sound sensitive areas and will be installed on spring vibration isolators.
- Fans will operate near their peak efficiency as this corresponds to the lowest noise level for the fan.
- The air distribution system will be designed for minimum resistance, consequently with minimum fan sound generation.
- Duct connections at both fan inlet and outlet will be designed for uniform and straight air flow.
- Sound generated by unitary equipment and air outlets will be minimized by proper selection of the type and output air velocity of the equipment.

Mechanical Towers

As indicated on the drawings, there are four Mechanical Towers: two on the north side of the building and two on the south side.

Each of the Mechanical Towers accomodates all the major mechanical equipment necessary for the proper operation of the building.

There are three levels in each Mechanical Tower:

- The lowest level contains the Main Supply Air Handling Unit and Electrically Driven Centrifugal Air Conditioning Refrigeration Machine.

- The mezzanine floor contains the main Return/Exhaust Fans, Heat Exchangers and Water Pumps.

- The upper level houses the Silencers, Cooling Tower and Boiler.

In addition, two of the four Mechanical Towers contain a Retail Fresh Air Supply Unit and one other Mechanical Tower accomodates the Diesel-Generator machine with its remote radiator.

Various Exhaust Fans will also be located in the Mechanical Towers as required by design conditions.

Wherever it is practical, mechanical components will be selected with partial stand-by: For example, a pumping system consisting of two pumps each sized at 50% of the full load.

This ensures that in event of a breakdown of any of the components, the system being served maintains reasonable capacity and flow.

Ice Making Process

The Ice Making Equipment Room is located on the lower level of the building at the east end adjacent to the Ice Rink.

Two electrically driven low pressure Centrifugal Refrigeration Machines using R-11 as the primary refrigerant and a 30% ethylene-glycol solution (brine) as the secondary refrigerant will produce and maintain the required ice conditions in the rink. The size of the machines are selected so that one machine will be able to produce ice in 24 hours, while the second smaller machine will be able to maintain the ice at the coldest required temperature of 24°F. The two machines operating together will be able to produce ice in less than 16 hours.

Three major alternatives were considered for the refrigeration system: (1) High pressure reciprocating chillers using ammonia as primary refrigerant; (2) High pressure reciprocating chillers, using R-22 as primary refrigerant; and (3) Low pressure centrifugal chillers in cascading mode, using R-11 as primary refrigerant. Of these, the last alternative "(3)" has been selected as the most suitable system. The logic is as follows:

System No. 1 High pressure ammonia was rejected because

(a) It requires qualified stationary engineers to operate.

(b) Ammonia is toxic, and can form explosive mixtures.

(c) It will require a special ventilation system to remove the ammonia in the case of a leakage.

(d) Protective clothing and masks are required to enter the room housing the ammonia chillers when a leak of ammonia is to be fixed.

(e) The repugnant smell of ammonia in a crowded building, located partly underground may cause panic in a case of a leak to the occupied space.

(f) Maintenance of reciprocating machines requires at least twice the time needed for centrifugal machines.

System No. 2 High pressure Freon R-22 was rejected, because it requires qualified stationary engineers and its maintenance is more time consuming than centrifugal low pressure units.

System No. 3 Has none of the disadvantages mentioned in (a) to (f) above but it may cost slightly more to operate.

It is believed however, that the somewhat higher operating cost normally associated with the low pressure R-11, or cascading system will be more than offset by the stepless capacity control associated with a low pressure system, the heat pump application, and the considerably reduced maintenance requirements.

Condensers for the Ice Making Refrigeration machines will use chilled water produced by the Air Conditioning Refrigeration Machines. This will facilitate the cooling of the brine to make the ice. At the same time it reduces the need of two additional cooling towers, and the space needed to install them.

Plastic pipe of adequate size, properly supported, will be used to convey the brine to the rink, and under the concrete floor for freezing and maintaining the ice surface.

The main brine headers, which are made out of steel, will be installed in a pipe trench. This trench will also be used as a ice melting pit when the ice is removed from the rink.

Plate coils are installed in the pipe trench to accomodate this latest function.

For the de-icing cycle, the brine will be heated through a condenser water heat exchanger and pumped through the plastic pipes and plate coils to warm up the concrete floor and break the ice bond.

The loose ice will be plowed into the pipe trench and melted by the plate coils. The resulting water will be carried away to the drain system.

A specially constructed and sized electric heating cable system under the floor of the ice rink will provide enough heat to prevent frost and associated heaving of structural components and rink floor. The electric heating cable systems is controlled by thermostatic controls.

Arena Air Conditioning System

Air conditioning of the Arena is provided by four constant volume air systems. The central air handling equipment is located on the lower level of each of the Mechanical Towers.

Each of the four central air conditioning units are designed for free cooling (using outside air, when its temperature is below 55°F) and will consist of the following major components:

- Fresh air intake with motorized dampers
- Air mixing plenum with return air connections and motorized dampers
- Snow melting coil (steam with integral face and by-pass)
- Filtering section
- Chilled water cooling coil bank

- Condenser water (low temperature heating water) reheat coil bank

- Supply fan section with motorized discharge dampers and steam humidifier.

A low pressure supply air duct is installed in the truss space of the roof to distribute the conditioned air.

Space thermostats reset the supply air temperature to maintain the required space conditions.

The quantity of fresh air required by the system is adjusted by modulating the air intake dampers according to the number of people occupying the space.

The controls are arranged to sequence the cooling and reheating to prevent cycling.

Humidification will be provided for special events, as required.

Supply air is introduced to the space through special high throw type supply air grilles.

The air distribution is designed so that the air flow will be controlled. During ice shows or hockey games air will not be flown above the ice surface.

Return air will be ducted from the mezzanine and the concourse level to the return air plenum in the Mechanical Tower.

The Return Air Fans are located on the mezzanine level of the Mechanical Tower.

The discharge side of the Return Air Fans are connected to the Supply Unit mixing plenum and an exhaust discharge, to permit variation of the amounts of return ajr and exhaust air to coincide with a free-cooling cycle and minimum fresh air set back control arrangements.

Snow melting coils will be heated by low pressure steam, generated by electric or gas fired boilers.

The chilled water cooling coil bank is supplied with chilled water from the chilled water distribution loop.

The Hot Water Reheat Coils are supplied with condenser water at 105°F available from the condensers - cooling towers water loop (Heat-pump).

Filter bank will provide 30% to 40% efficiency filtering of supply air to the Arena/Trade Centre.

The controls will be fully automatic, with complete monitoring and automatic controls by the computerized Building Automation System.

A control console will be installed in the operator's room.

Retail Air Conditioning System

Chilled water piping loop, complete with valved and capped connections will be made available in the ceiling space of the retail area for later use by the various tenants.

These connections will be used to supply the necessary chilled water to the 100% recirculating fan-coil units which will be installed by/or for the tenants.

Fresh air will be supplied to the retail area through two dedicated units located in two of the Mechanical Towers.

No provision for kitchen exhaust is provided in the retail area, consequently retail uses containing kitchens will require special considerations for grease and odour removal.

Miscellaneous Air Conditioning Systems	Ducted fan-coil units using chilled water or condenser water will be provided to the various areas such as offices, entrances, lobbies, concourse area and ticket office. During peak hours entrances will be heated utilizing steam projection unit heaters.
Ventilation For Transformer Rooms	An exhaust-ventilation system will be installed in the electrical substation and switchgear room to maintain the temperature required by code. The system will be fully automatic, thermostatically controlled with "trouble alarm" indication.
Miscellaneous Exhaust Systems	An exhaust system will be provided for ventilation of washrooms, locker rooms, restrooms, showers, janitor's closets and soiled utility rooms in accordance with appropriate codes. The ramp and loading dock will be exhausted and ventilated in accordance with the Ontario Building Code. To reduce operating cost, carbon monoxide monitors with all necessary alarm signals will start and stop the ventilating fans in vehicular traffic and parking areas.
Smoke Exhaust	Smoke control measures utilizing the proposed building air system have been included in the design. Smoke exhaust will be handled by the return/exhaust fans of the four air handling units serving the arena and two dedicated smoke exhaust fans serving the retail space.

During a fire alarm all the fan systems will shut down and the discharge dampers on the supply fans will close so that smoke migration will be minimized.

The return/exhaust fans may be re-started in a selective mode so that the smoke can be exhausted.

Plumbing And Fire Protection

Building storm and sanitary drainage connections to York Boulevard are proposed. Sewage and storm water sumps complete with duplex pumps will be required for drainage of Rink/Exhibition Hall Level and weeping tile system.

Building domestic water and fire protection systems will be served from two water services: a 12" main in Bay St. and a 12" main in York Boulevard.

Domestic hot water systems will consist of 105°F water to washrooms, showers and concession stands. 180°F water to the ice making area. It is anticipated that the Restaurant facility will provide for its own hot water requirements.

Domestic hot and cold water, waste and vent connections will be provided for all plumbing fixtures. Plugged and capped waste, vent and cold water connections will be provided for Retail Mall tenants.

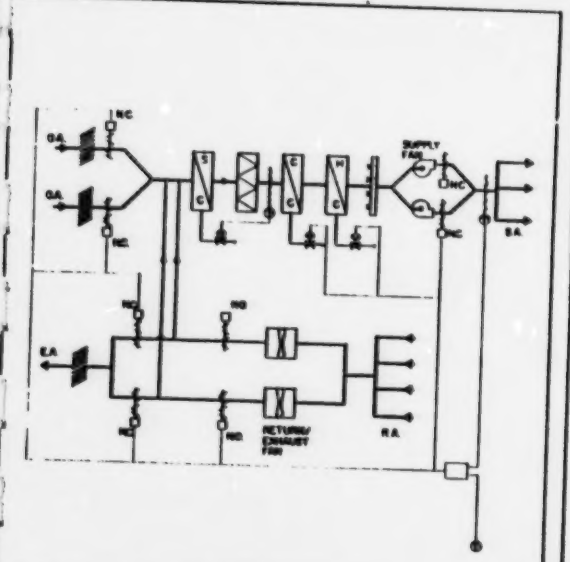
Roof drainage system will be of conventional design.

Gas service to Trade Centre and Arena to supply heating and kitchen requirements is under investigation by Union Gas Ltd. A new gas main may have to be extended to the site to meet necessary requirements.

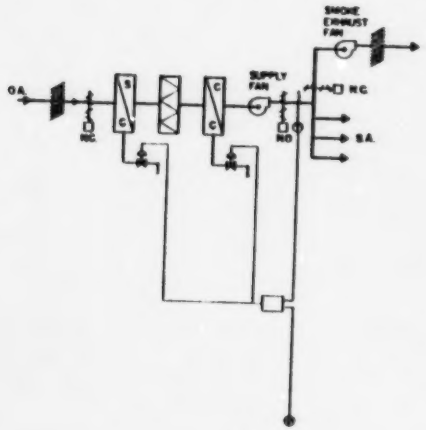
A fire standpipe system, supplied from a 70 gpm pump located in Mechanical room at Rink/Exhibition hall level complete with siamese pumper connections shall serve the cabinets for the entire building.

Fire hose cabinets shall be double valve type, with 1½" valve with 75'-0" of hose, a 2½" U.L. approved valve for Fire Department use and a pressurized water extinguisher. Dry chemical and CO_2 extinguishers shall be provided in Mechanical and Electrical rooms and other areas of special hazard. The complete system shall be provided in accordance with the requirements of the Ontario Fire Marshals office and the Ontario Building Code.

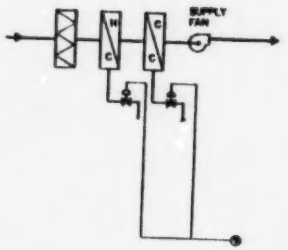
The entire building will be protected by a sprinkler system. A sprinkler header will be located in Mechanical room at Rink/Exhibition Hall Level, complete with siamese pumper connections and test header. Note: Water flow tests will be conducted to determine if pumps will be required. Systems will be based on ordinary hazard design in accordance with N.F.P.A. Code 13. All zoning shall be in accordance with Ontario Building Code requirements.



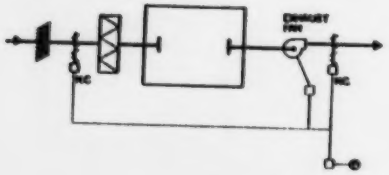
ARENA SUPPLY AIR UNIT (TYPICAL FOR 4 UNITS)



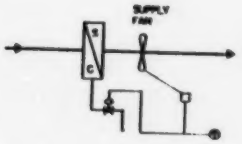
RETAIL FRESH AIR SUPPLY UNIT (TYPICAL FOR 2 UNITS)



FAN COIL UNITS



ELECTRICAL ROOM VENTILATION



STEAM PROJECTION UNIT HEATERS

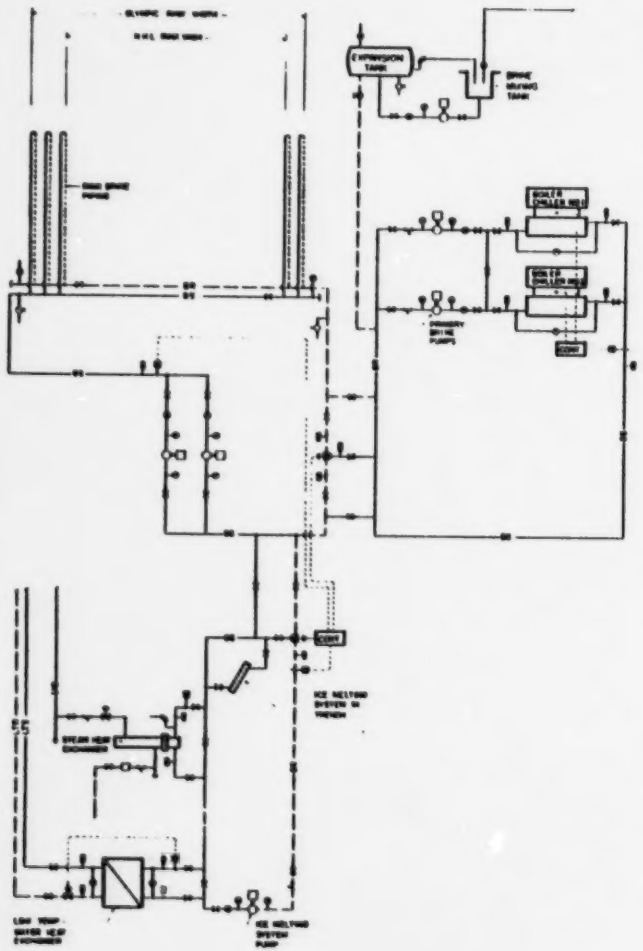
LEGEND

- MOTORIZED DAMPER
- LOUVRE
- STEAM COIL
- FILTER BANK
- COOLING COIL
- HEATING COIL
- HUMIDIFIER
- THERMOSTAT
- CONTROL VALVE
- O.A. OUTSIDE AIR
- E.A. EXHAUST AIR
- R.A. RETURN AIR
- S.A. SUPPLY AIR

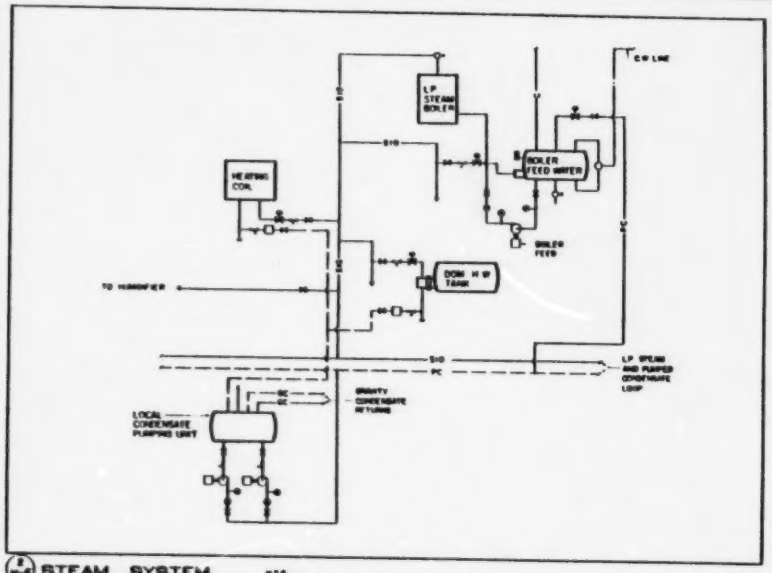
Hamilton Trade Centre & Arena

Parkin

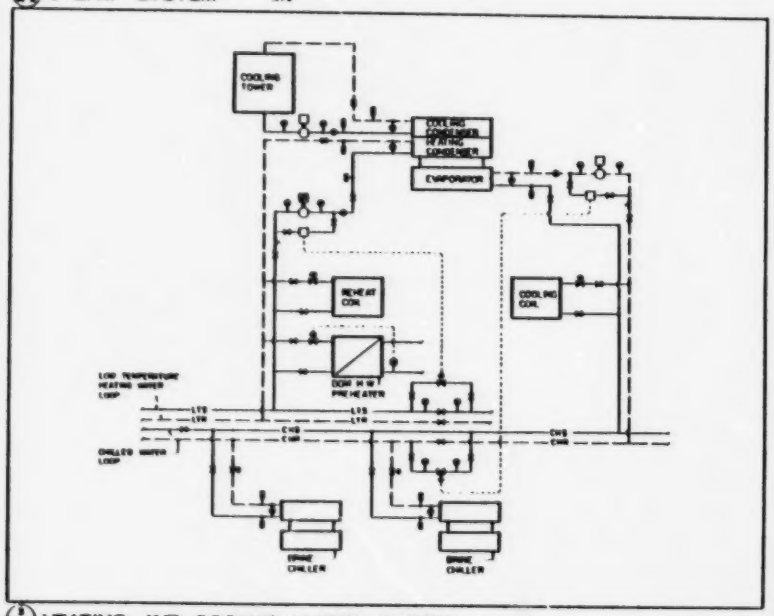
AIR FLOW SCHEMATICS



BRINE SYSTEM



STEAM SYSTEM



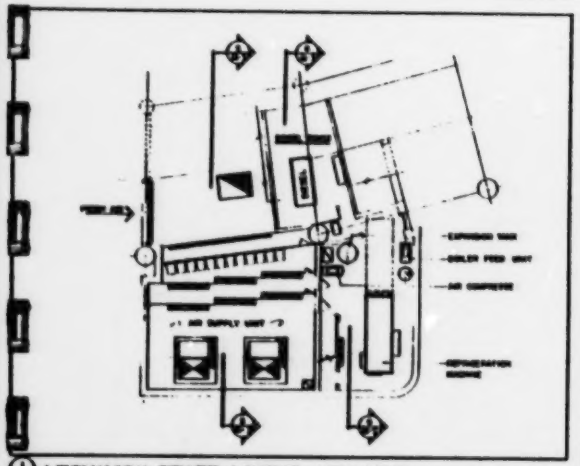
HEATING AND COOLING WATER SYSTEM

Hamilton Trade Centre & Arena

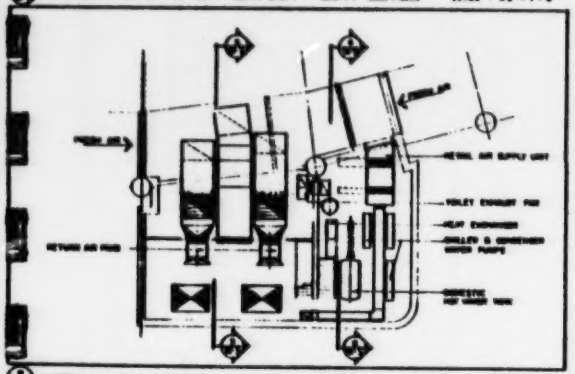
Perkin

LIQUID FLOW SCHEMATICS

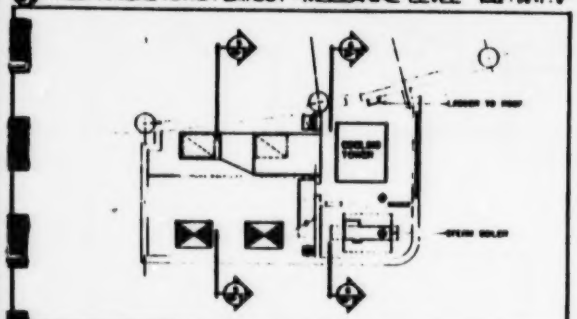
M-2



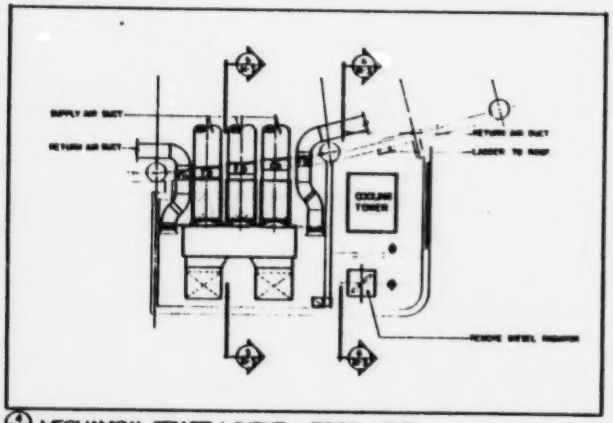
MECHANICAL TOWER LAYOUT - LOW LEVEL



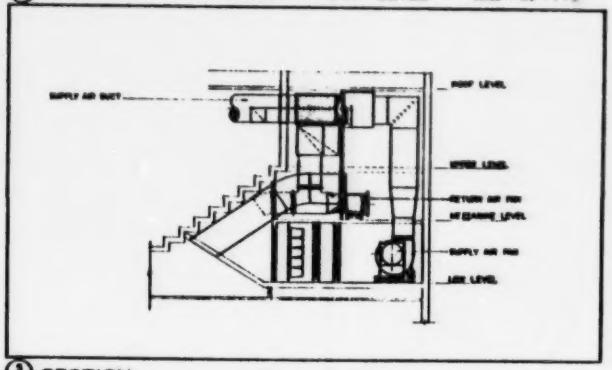
MECHANICAL TOWER LAYOUT - MEZZANINE LEVEL



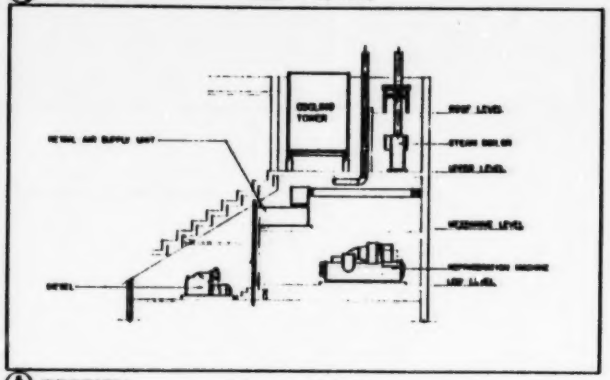
MECHANICAL TOWER LAYOUT - UPPER LEVEL



MECHANICAL TOWER LAYOUT - ROOF LEVEL



SECTION



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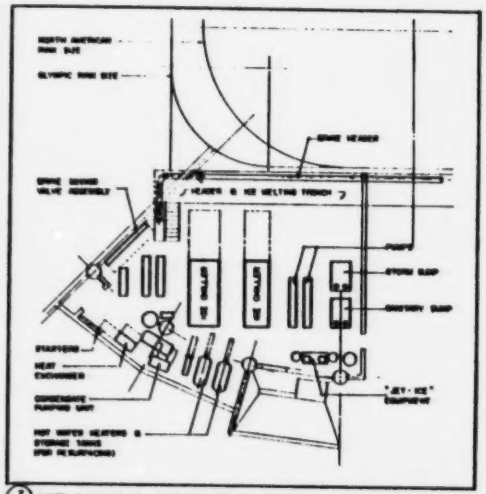
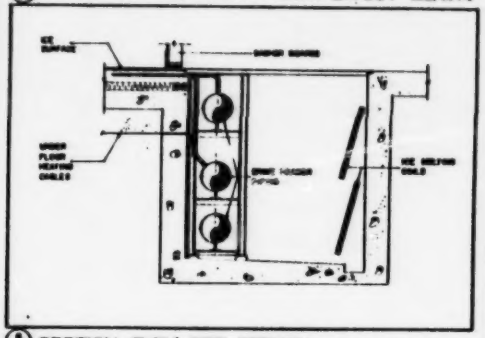


ICE-MAKING EQUIPMENT ROOM LAYOUT



SECTION THRU' PIPE TRENCH

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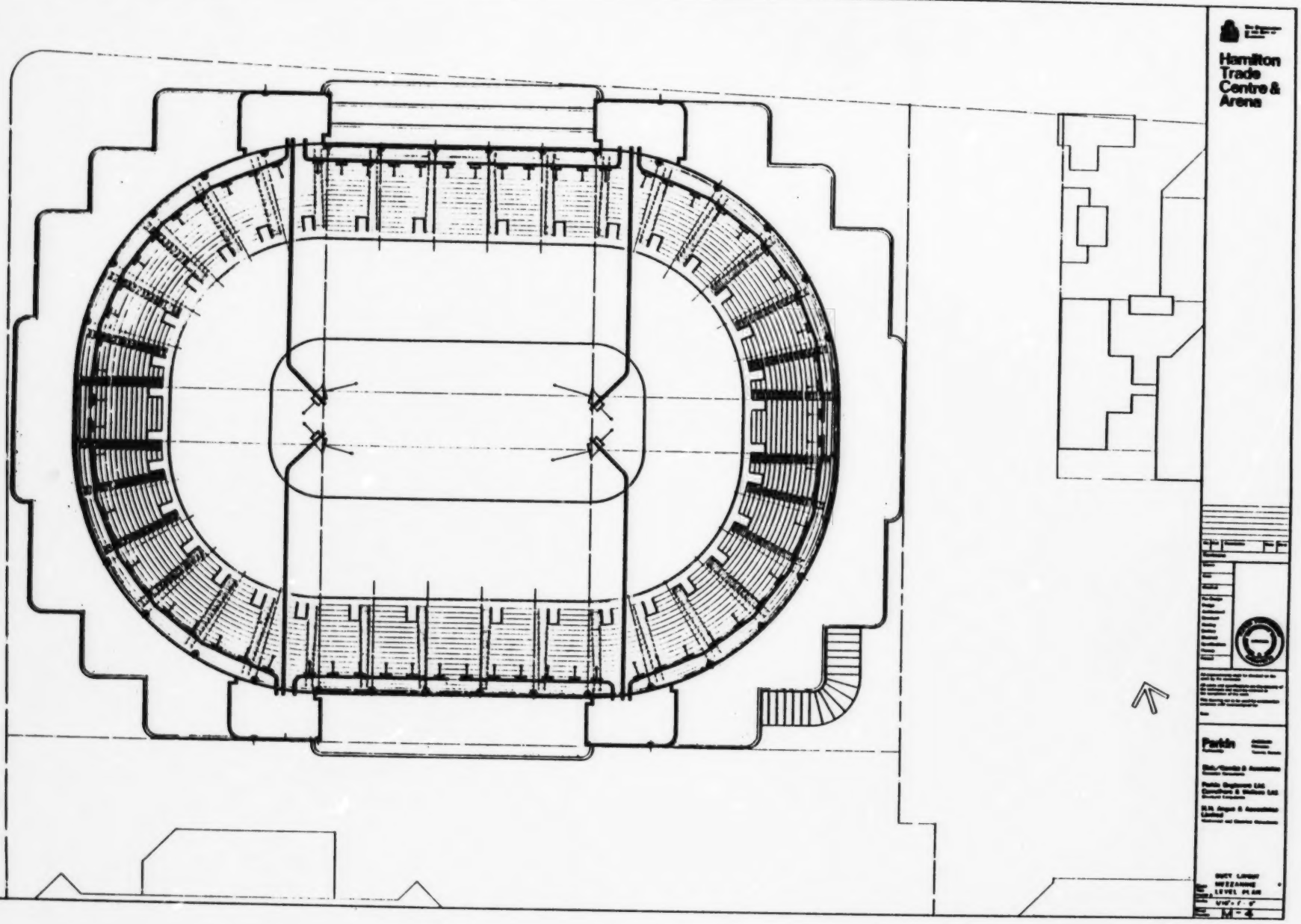
Parkin

M-3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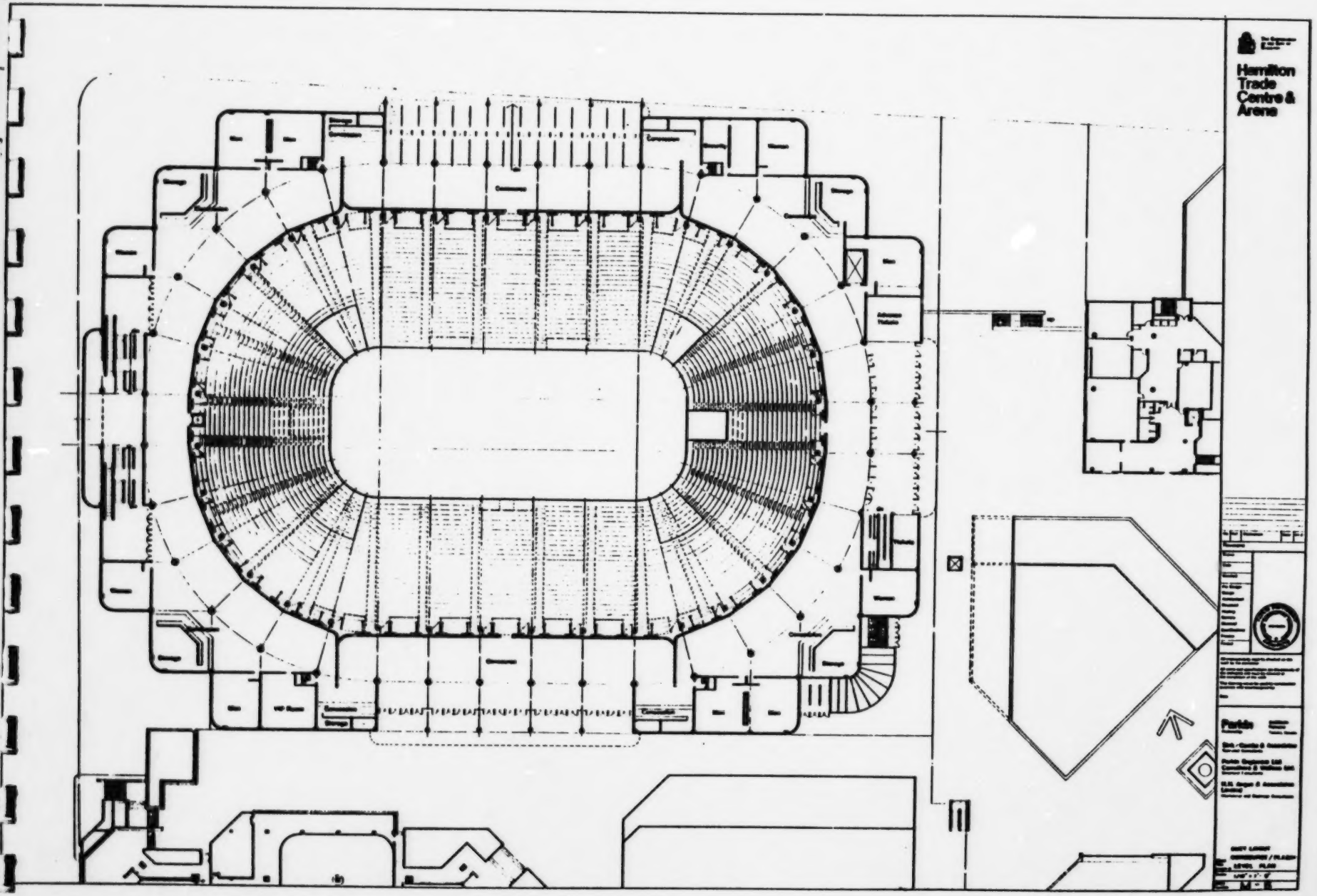
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ELECTRICAL ENGINEERING SYSTEMS

Incoming Electrical Service

An electrical service, consisting of two lines at 13.8 kV will be brought to the site from the Hamilton Hydro Electric System on Bay Street, in a concrete encased ductbank.

The new service will enter a free-standing 13.8 kV switchboard.

The main 13.8 kV switchboard will consist of two main switches, one for each Hydro line, a bus tie switch, two metering sections with totalized metering and fused switches to supply the Distribution System.

The two incoming lines from Hamilton Hydro Electric System operates with one line energized and one line as standby.

Electrical Distribution System

Feeders from the 13.8 kV switchboard will supply to the main 13.8 kV - 600 volt transformers located in the Main Electrical Room at rink level. The secondary 600 volt power will in turn be distributed from the main 347/600 volt, 3 phase, 4 wire switchboard.

A major 120/208 volt, 3 phase, 4 wire distribution substation is proposed for receptacle power for the retail shops on the Street/Mall Level, as well as heating cables under the rink.

Power will be distributed from the 347/600 volt, 3 phase, 4 wire switchboard through electrical closets. Panels for lighting and receptacle loads, fed from these risers, will also be located in these electrical closets. The electrical closets are strategically located throughout the building as a practical method of concealing and concentrating electrical panels.

In the Exhibition Area a complete 120/208 volt power and telephone distribution system will be provided for exhibitions. To supply power

for exhibitors in the arena, four movable cubicles will be provided that will come complete with transformer and 120/208 volt, 3 phase, 4 wire lighting panel. These portable units will then plug into a 600 volt receptacle mounted on columns.

Motor loads, such as mechanical and elevators will be fed directly from the main switchboard at 600 volts.

Refer to the "Single Line Diagram" for a schematic view of the Electrical Distribution System.

Emergency Power System

An Emergency Power Generating System will be located on the Concourse Level in the Diesel Generator Room to provide emergency lighting for egress and for the fire pump and other miscellaneous loads. The diesel generator will be independent of city water and will be air-cooled through a remote rad.

Fuel supply to the unit will be supplied from a main oil storage tank located on the rink level within the building in a location accessible to an oil truck.

The oil tank will be sized to run the diesel generator for a minimum of 24 hours. The fuel pump set will supply the fuel to the diesel generator and shall be located in Fuel Tank Room.

The Insulated Exhaust System will consist of a muffler and steel pipe terminated above the tower roof.

Feeders from the 347/600 volt, 3 phase, 4 wire switchboard will feed two automatic transfer switches, which in turn will feed an 347/600 volt, 3 phase, 4 wire emergency switchboard and fire pump.

Emergency power will be distributed at 347/600 volt, 3 phase, 4 wire through electrical closets. Panels for lighting and miscellaneous loads, fed from these risers, will also be located in the electrical closets.

Refer to the "Single Line Diagram" for a schematic view of the Emergency Power System.

Lighting

A combination of metal halide, high pressure sodium mercury, fluorescents, and limited low voltage incandescents will be used throughout the project.

Lighting for the ice surface will be metal halide located on catwalks on both sides of the playing area. Luminaires will be supported from a 4'-0" wide catwalk system located in the lower level of the roof trusses. The arrangement and aiming of luminaires will be such as to minimize glare. Relamping will be accomplished from the catwalk. This lighting design suitable for television, will provide lighting for the following events:

- Sporting Events
- Trade Shows
- Conventions
- Musical Events
- Special Functions

Incandescent lighting of a lower level will be provided as well for the special functions such as ice shows which require blackouts and the subsequent instant-on feature.

The Arena Lighting as well as the Arena Paging System will be controlled from a Central Control Room located on the Concourse Level using a Low Voltage Control System.

Lighting for boxing and wrestling will be an independent system and will be provided by using luminaires mounted within the scoreboard to provide the recommended level of illumination. Relamping will be accomplished from the ground by lowering the scoreboard.

A motorized raise and lower steel frame system will be provided over the stage area to accommodate luminaires for road shows, however Theatrical lighting and dimming equipment is not provided. A separate 600 volt feeder will be run to this area for lighting.

In the Exhibition Hall, Ramp Area, Loading Dock, Concourse and on the exterior, high intensity discharge luminaires will provide adequate levels of illumination. Special lighting will be provided at the entrances and ticket booths.

Fluorescent lighting will be provided in offices, corridors, lockers, concession booths, storage areas, electrical and mechanical rooms.

When high intensity charge lamps are used, incandescent lamps will be provided, either installed in the luminaire or remote, for emergency lighting. These lamps will remain on until the high intensity discharge reaches 70% or more of its light output. In addition, long life incandescent lamps will be provided for aisle lighting.

Life Safety Support System

The Fire Alarm System will be a system that meets CSA and the Ontario Building Code Requirements and Local Municipal Fire Department.

The components required to meet the requirements of these standards are as follows:

- Manual pullstations
- Fire alarm devices - detectors such as surface or smoke duct mounted ionization type smoke detectors, thermal type
- Voice communication, ie. speakers located in corridors, places of assembly and stairwells
- Tie into adjacent Shopping Mall
- Shut down feature for air handling systems
- All magnetically held open doors will be released
- Sprinkler flow or check valves shall be zoned indicating a trouble condition
- Annunciators located at appropriate entrances
- Central station connection

Empty Conduit For Telephone System

A complete system of outlets, empty conduits and closet backboards will be provided for installation of wiring and equipment by the telephone supplier.

Lightning Protection System

The building will be equipped with a Lightning Protection System including aerial terminals on the roof, down drop conductors embedded in the columns and connected to a loop system under the ground.

Miscellaneous System

- A complete Cable Tray System will be provided throughout the complex for television and radio cables.

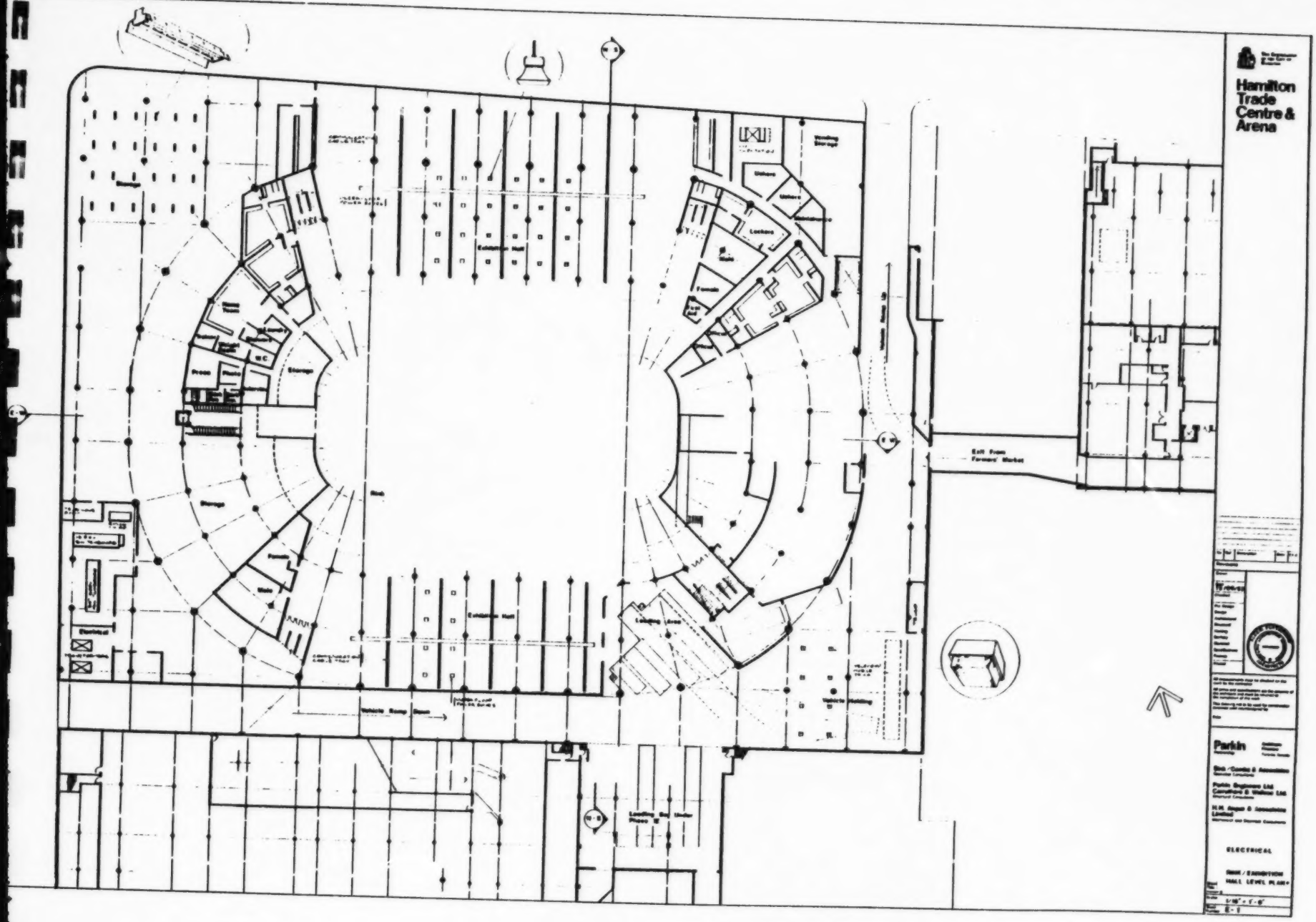
- Power supply of about 750 KVA near the stage area for use by road shows.

- Audio systems for arena and exhibition areas.

- Empty raceway for special systems such as sports timer, scoreboard control, special spotter intercom, and audio system for hearing impaired.

- Goal lights and buzzer system

- Power supply to demineralizing system.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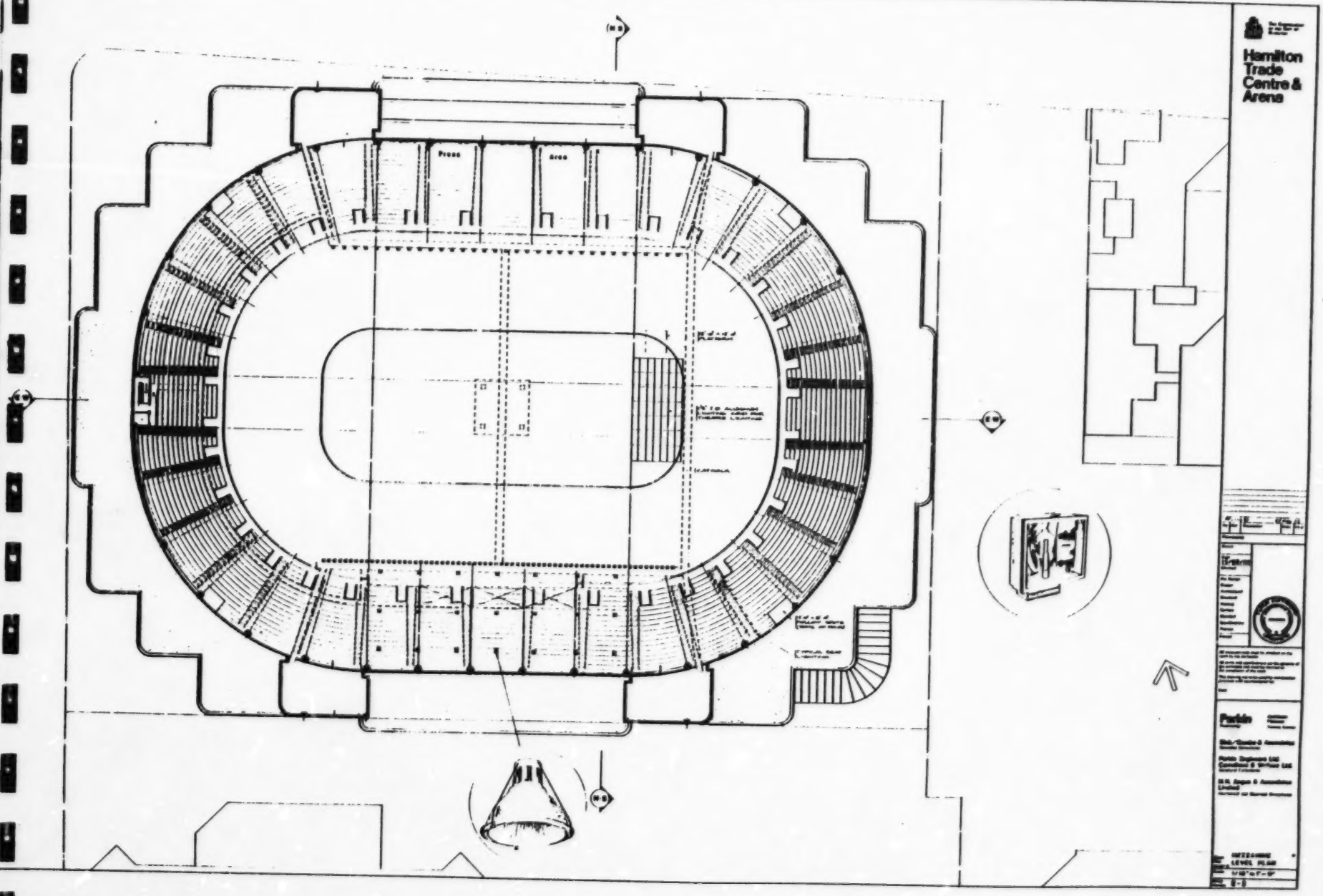
ELECTRICAL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